

JEE 634 Climate Influence on Buildings and End-use Requirements

(Course coordinator: Aj. Pipat Chaiwiwatworakul)

1. Course Description

This course introduces students to the phenomena related to the use of energy in buildings. Students will learn mechanisms and method of calculation for air properties, thermal comfort, air-conditioning load, and energy use in buildings. It covers a board topic of influences and energy use of buildings, solar radiation and climate, air psychrometry, thermal comfort, air-conditioning, air flow in buildings, lighting, building energy code, and estimation and management of energy use in buildings with the use of a building energy code program.

2. Target Knowledge, Skills, and Abilities (KSA)

This course provides students with basic knowledge on tropical climate, building technologies and building energy code, skills to assess building energy performance, and an ability to combine theoretical knowledge and analytical skills to address and identify measures for the building energy efficiency.

3. Target group of students

The course is opened to Master and PhD students with a background in science or engineering.

4. Pre-requisites

This course has no pre-requisites.

5. Course Learning Outcomes

CLO 1: Able to explain the influence of climate on building and energy use requirements.

CLO 2: Able to explain the technologies of envelope, air-conditioning and lighting for building energy efficiency.

CLO 3: Able to assess the building energy performance according to Thailand building energy code.

6. Method of Teaching and Learning

This course will be delivered in a hybrid format, i.e. a combination of online and on-site lectures and presentations.

7. Course Outline and Organization

This course is opened every Semester. For the Semester 2/2023 (2566), this course is scheduled every Tuesday afternoon (13.30 am – 16.30 pm) from Tuesday 23 January to 7 May 2024.

MODULE 1: TROPICAL CLIMATE AND BUILDING ENERGY USE		
MLO 1: Gain knowledge on tropical climate and building energy use		
MLO 2: Can calculate the incident solar radiation on planes		
MLO 3: Can determine the influence of sun shading and good window system		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: Introduction Course overview The significance of energy use in buildings Building end-use energy in Thailand	Prof. Surapong	Week 1 23 Jan 2024
LECTURE 2: Perspective view on energy requirements in buildings The indoor requirements and the varying outdoor environment Factor affecting energy use	Prof. Surapong	Week 2 30 Jan 2024
LECTURE 3: Solar geometry Solar radiation on inclined plane	Dr. Pattana	Week 3 6 Feb 2024
LECTURE 4: SUN SHADING Sun shading Thermal properties of windows	Dr. Pattana	Week 4 13 Feb 2024
EVALUATION: <u>take-home work and mid-term exam</u>		

MODULE 2: BUILDING SYSTEMS		
MLO 1: Can determine the properties of moist air		
MLO 2: Gain the knowledge of thermal comfort and air-conditioning in building		
MLO 3: Gain the knowledge of visual comfort and lighting in building		
MLO 4: Can calculate the air-conditioning and lighting performance		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: AIR PSYCHROMETRY Air psychrometry Properties of processed air	Dr. Pipat	Week 5 20 Feb 2024
LECTURE 2: THERMAL COMFORT Thermal comfort and ventilation requirement Thermal comfort under controlled environment Adaptive comfort and energy implication	Prof. Surapong	Week 6 27 Feb 2024
LECTURE 3: AIR CONDITIONING Option to achieve thermal comfort Ventilation	Dr. Pipat	Week 7 5 Mar 2024
LECTURE 4: AIR CONDITIONING 2 Space cooling load	Dr. Pipat	Week 8 12 Mar 2024

LECTURE 5: LIGHTING Quantities and properties of light Vision and perception Lighting methods Lighting equipment	Prof. Surapong	Week 9 19 Mar 2024
EVALUATION: <u>assignment and mid-term exam</u>		Week 10 26 Mar 2024

MODULE 3: BUILDING PERFORMANCE		
MLO 1: Can explain technologies for building energy efficiency for the tropics		
MLO 2: Gain in-depth knowledge on building energy code		
MLO 3: Can apply building energy code to determine the building energy performance		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: RESEARCH LAB VISIT Energy efficient technologies for buildings	Dr. Pipat	Week 11 2 Apr 2024
LECTURE 2: BUILDING ENERGY CODE 1 Building envelope performance index and requirements	Dr. Pipat	Week 12 9 Apr 2024
LECTURE 3: BUILDING ENERGY CODE 2 Lighting system and AC system performance index and requirements	Dr. Pipat	Week 13 23 Apr 2024
LECTURE 4: BUILDING ENERGY CODE 3 Whole building energy compliance	Dr. Pipat	Week 14 30 Apr 2024
EVALUATION: <u>assignment and final exam</u>		Week 15 7 May 2024

8. Evaluation Methods

Module 1: The exam consists of take-home work and mid-term exam (30% overall grade for the course)

Module 2: The exam consists of assignment and mid-term exam (40% overall grade for the course)

Module 3: The exam consists of assignment and final exam (30% overall grade for the course)

9. References/Resources

1. Chirarattananon, S. (2005) *Building for Energy Efficiency*, Asian Institute of Technology.