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 1/2025 (2568), this course is scheduled every Friday morning (9.00 am – 12.00 pm) from Friday 8 August to 14 November 2025.

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	Dr. Pattana	Week 1 8 August 2025
LECTURE 2: Perspective view on energy requirements in buildings The indoor requirements and the varying outdoor environment Factor affecting energy use	Dr. Pattana	Week 2 15 August 2025
LECTURE 3: Solar geometry Solar radiation on inclined plane	Dr. Pattana	Week 3 22 August 2025
LECTURE 4: SUN SHADING Sun shading Thermal properties of windows	Dr. Pattana	Week 4 29 August 2025
EVALUATION: take-home work and mid-term exam		

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 5 September 2025
LECTURE 2: THERMAL COMFORT Thermal comfort and ventilation requirement Thermal comfort under controlled environment Adaptive comfort and energy implication	Dr. Pipat	Week 6 12 September 2025
LECTURE 3: AIR CONDITIONING Option to achieve thermal comfort Ventilation	Dr. Pipat	Week 7 19 September 2025

LECTURE 4: AIR CONDITIONING 2 Space cooling load	Dr. Pipat	Week 8 26 September 2025
LECTURE 5: LIGHTING Quantities and properties of light Vision and perception Lighting methods Lighting equipment	Dr. Pipat	Week 9 3 October 2025
EVALUATION: assignment and mid-term exam		Week 10 10 October 2025

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 17 October 2025
LECTURE 2: BUILDING ENERGY CODE 1 Building envelope performance index and requirements	Dr. Pipat	Week 12 24 October 2025
LECTURE 3: BUILDING ENERGY CODE 2 Lighting system and AC system performance index and requirements	Dr. Pipat	Week 13 31 October 2025
LECTURE 4: BUILDING ENERGY CODE 3 Whole building energy compliance	Dr. Pipat	Week 14 7 November 2025
EVALUATION: assignment and final exam		Week 15 14 November 2025

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.