CA2626: THERMAL ENGINEERING FOR BUILDING ENGINEERS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Thermal Engineering for Building Engineers

Subject Code
CA - Civil and Architectural Engineering
Course Number
2626

Academic Unit
Architecture and Civil Engineering (CA)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

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

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
BC2626/BC2626F/BC2626P Thermal Engineering for Building Engineers

Exclusive Courses
Nil

Part II Course Details

Abstract

The course aims to provide fundamental knowledge of thermodynamics, heat transfer, fluid mechanics and dynamics as the foundation in the study of building services engineering and provide the thermofluid engineering theories in the study of refrigeration, flow of bodies and inside ducts and pipes.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	discover the cooling and heating effects through investigation of thermodynamic properties in the refrigeration cycles in air-conditioning systems;		x		
2	interpret and apply thermofluid engineering theories to solve basic psychometric problems in buildings;		x	x	
3	analyse heat transfer performance in building structures and building services pipelines; and			x	
4	apply the equations of fluid motion to solve a variety of fluid flows problems in ducts and pipes and over buildings.			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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain key concepts of thermal engineering and its applications in architectural engineering systems.	1, 2, 3, 4	
2	Laboratory	Practise the concepts of thermal engineering and discover the deviations between the theories and experiments.	1, 2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term Test	1, 2, 3, 4	20	
2	Coursework: Laboratory report	1, 2, 3, 4	30	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

To pass a course, a student must obtain minimum marks of 30% in both coursework and examination components, and an overall mark of at least 40%.

Assessment Rubrics (AR)

Assessment Task

Mid-term Test

Criterion

1. ABILITY to ANALYSE the heat transfer process and SOLVE fluid flow problems in pipes and ducts.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Coursework: Laboratory report

Criterion

1. ABILITY to DISCOVER and INTERPRET the thermodynamics properties and the basic psychometric problems in buildings

Excellent (A+, A, A-)

High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Examination

Criterion
1. ABILITY to ANALYSE the heat transfer process and SOLVE fluid flow problems in pipes and ducts.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Fundamental laws of thermodynamics. Non-flow and steady flow energy equations. Reciprocating compression cycle. Basic heat transfer. Refrigeration cycle. Psychometric mixtures. Properties of Fluids. Viscosity. Laminar and Turbulent Fluid Flow. Boundary Layer. Basic Fluid Mechanics and Dynamics. Continuity, Momentum and Energy Equations for Fluid Flows and Air flow in ducts and pipes, as well as flow over buildings and structures.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Eastop, T.D. & McConkey, A. (1993), Applied Thermodynamics for Engineering Technologists, 5th ed. Longman, Essex, England. (TJ265.E23 1993)

2	Douglas, J.F., Gasiorek, J.M. & Swaffield, J.A. (2001), Fluid Mechanics, 4th ed. Prentice-Hall, Upper Saddle River, NJ. (TA357.D68 2001)
3	American Society of Heating, Refrigerating and Air-Conditioning Engineers (2005), ASHRAE Handbook: Fundamentals. (TH7201.A823 2005)
4	Jones, W.P. (2001), Air Conditioning Engineering, 5th ed. Butterworth-Heinemann, Oxford. (TH7687.J663 2001)
5	Martin, P.L. & Oughton, D.R. (2002), Faber & Kell's Heating and Air-conditioning of Buildings, 9th ed. Butterworth-Heinemann, Oxford. (TH7222.F3 2002)
6	Kuehn, T.H., Ramsey, J.W. & Threlkeld, J.L. (1998), Thermal Environmental Engineering, 3rd ed. Prentice-Hall, Upper Saddle River, NJ. (TH7121.T39 1998)
7	Online Resources: American Society of Heating Refrigeration & Air-conditioning Engineers (ASHRAE) - http://www.ashrae.org