



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

**UNIVERSITY EXAMINATION FOR THE DEGREE IN SCIENCE IN
CONSTRUCTION MANAGEMENT**

**2ND YEAR 1ST SEMESTER 2024/2025 ACADEMIC YEAR
CENTRE: MAIN CAMPUS**

COURSE CODE: TCB 1207

COURSE TITLE: BUILDING SCIENCE

EXAM VENUE: STREAM: BSc. CONSTRUCTION MGT

DATE:15/1/2025 EXAM SESSION:9-11.00 AM

DURATION: 2 HOURS

Instructions

- 1. Answer question 1 (Compulsory) and ANY other two questions**
- 2. Candidates are advised not to write on question paper**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

Question One

(a) State and define Zeroth law of thermodynamics, first law, second law and third law of thermodynamics and state the relevance of each law to heat transfer in buildings. [12 Marks]

(b) Briefly explain and define each of the three modes of heat transfer in buildings:

(i) Conduction mode; the basic equation for thermal conduction is the Fourier's law, state it, give its equation and explain meaning of each symbol in the equation. [4 Marks]

(ii) Convection mode; the basic equation for thermal convection is the Newton's law of cooling, state it and give its equation, explain the meaning of each symbol in the equation. [4 Marks]

(iii) Radiation; the basic equation for radiation heat transfer is the Stefan- Boltzmann law, state it and give its equation and explain each symbol in the equation. [4 Marks]

(c) A surface at 20 degree centigrade exposed to the surrounding at 110-degree centigrade converts and radiates heat at the surroundings. The convection coefficient and radiation factor are 750W/m^2 degree centigrade and unity respectively. If the heat is conducted to the surface through a solid conductivity 10W/m^2 centigrade, what is the temperature gradient at the surface in the solid? [6 Marks]

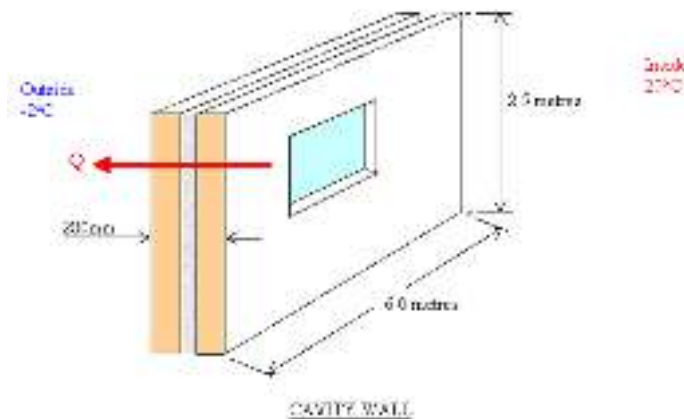
Question Two

(a) Explain clearly the meaning of term thermal performance of buildings. [2 Marks]

(b) With of a labelled building sketch, explain the various heat flows through the building elements. [4 Marks]

(c) With a labelled sketch of a human body, explain clearly the various heat-flows through the building elements and mention how the body exchanges heat with its surroundings [10 Marks]

(d) Calculate the heat flow through the wall shown below. [04 Marks]



The 'U' value for the blockwork in the wall is $0.317 \text{ W/m}^2\text{°C}$

The 'U' value for the double-glazed window is $2.8 \text{ W/m}^2\text{°C}$.

The window size is 2.0 m long x 1.0 m high.

Question Three

- (a) What is thermal insulation and what its function and main aim in buildings? [03 Marks]
- (b) Describe in point form the general principles of thermal insulation in buildings. [05 Marks]
- (c) How are thermal insulation materials classified? [02 Marks]
- (d) Outline the benefits of thermal insulation, giving illustration where applicable. [10 Marks]

Question Four

- (a) Define acoustics, giving examples and its purpose in buildings. [03 Marks]
- (b) Why is proper design and planning needed for construction of a hall or auditorium? [02 Marks]
- (c) List and briefly discuss each of the six major factors affecting acoustics of buildings. [10 Marks]
- (d) For an empty assembly hall of size $20 \times 15 \times 10$ cubic meters with absorption coefficient 0.106. Calculate reverberation time. [5 Marks]

Question Five

- (a) Define noise and lists its three major effect s of noise in buildings. [05 Marks]
- (b) Differentiate between the sound materials and sound absorbers [05 Marks]
- (c) Explain what is meant by sound insulation and its function [05 Marks]
- (d) Outline the five general considerations in sound insulation in buildings [05 Marks]