

**W1-2-60-1-6**

**JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2018/2019**

**THIRD YEAR EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE IN ARCHITECTURE**

**ABA 2304: BUILDING ENVIRONMENT SCIENCE I (THERMAL)**

**DATE: DECEMBER, 2018 TIME: 2 HOURS**

INSTRUCTIONS: ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

**QUESTION ONE: 30 MARKS**

a. List down the climatic zones found in Kenya. (6 marks)

b. Explain the factors that affect thermal comfort. (8 marks)

c. Solar radiation is a general term for electromagnetic radiation emitted by the sun. The amount of solar radiation that reaches any sport on the earth’s surface varies according to a number of factors. Discuss

(6 marks)

d. Define the following terms:- (3 marks)

i. Thermal resistivity.

ii. Thermal transmittance

iii. Sola-air temperature

e. Using well annotated diagram, illustrate how thermal chimney works. (4 marks)

f. What do you understand by the term *Thermal Bridging*. (3 marks)

**QUESTION TWO: 20 MARKS**

a. For objects other than an ideal black body, The Stephen Boltzman Law can be expressed as follows;

Q= 6T4A. Explain. (2 marks)

b. Explain the heat exchange processes of buildings. (4 marks)

c. i. A 5 x 5m and 2.5m high office is located on an intermediate floor of

a large building, therefore it has only one exposed wall facing south, all other walls adjoin rooms kept at the same temperature; Ti=200c. Ventilation rate is 3 air exchanges per hour. 3 No Too W bulbs are inn continuous use to light the rear part of the room, which is used by four clerical workers. The exposed 5 x 2.5m wall consists of a single glazed window, T.5 x 5m, (u-value 4.48w/m2 deg C) and a clinker concrete spand vell wall, 200mm thick, rendered and plastered 1 x 5m (u-Value 1.35W/m2 deg C).

Calculate total rate of heat loss given the external temperature

is –Ioc. (12 marks)

ii. Assume each person emits 140w. Calculate the amount of mechanical heating required to keep the internal temperatures balanced at 200c. (2 marks)

**QUESTION THREE: 20 MARKS**

a. Write short notes to analyze shelter for warm and humid climates. (10 marks)

b. Using diagrams when necessary, outline the characteristics of Urban heat Island. (8 marks)

c. What is your understanding of passive solar cooling. (2 marks)

**QUESTION FOUR: 20 MARKS**

a. There are four fundamental shading strategies. Using well annotated diagrams, illustrate how these strategies can be used in design to achieve thermal comfort. (12 marks)

b. The goal of all passive solar heating systems is to capture the sun’s heat within the building’s elements and release that heat during periods when the sun is not shining. At the same time keeping the same space comfortable.

Discuss the three approaches to passive solar systems outlining relevance to local design challenges for the thermal comfort. (8 marks)