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

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

# **UNIVERSITY EXAMINATIONS 2017/2018**

THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF ARCHITECTURAL TECHNOLOGY

**ABA 2304 : BUILDING ENVIRONMENT SCIENCE [THERMAL]**

**DATE: JANUARY 2018 TIME: 2 HOURS**

**INSTRUCTIONS:**

**ANSWER QUESTION ONE [COMPULSORY]AND ANY OTHER TWO QUESTIONS**

**==========================================================QUESTION ONE [30 MARKS]**

1. Solar radiation is a general term for the electromagnetic radiation emitted by the sun. The amount of solar radiation that reaches any spot on the earth’s surface varies according to a number of factors. Discuss. [5 marks]
2. (i) The radiation energy per unit time from a black body is governed by Stefan-Beltzman Law. Calculate the rate of heat loss from an emitting surface (6mx4m), at a temperature of 2000C. The stafan- Boltzman’s constant is given as 5.6 x 10-8 (W/M2K4). [3 marks]

(ii) Assuming the emitting surface is gray. Explain how the answer in b(i) would be different. [2 marks]

1. Define the following terms: [3 marks]
2. Thermal resistivity
3. Climatology
4. Thermal transmittance
5. Explain how Thermal Chimney works, use of well annotated diagrams is highly encouraged. [5 marks]
6. In building climatological site analysis, wind and humidity component is very important. Using well annotated sketches illustrate your response to wind, on the 14 falls sites for the resort in ABA 2306. [6 marks]
7. Using diagrams where necessary, outline the characteristics of Urban Heat Island. [6 marks].

**QUESTION TWO [20 MARKS]**

1. Define the following terms: [6 marks]
2. Operating temperature
3. Standard effective temperatures (SET)
4. Predicted Mean Vote.
5. Assume that the outside air temperature is 320C with a relative humidity of 60%. Use the psychrometric chart to determine :
6. The specific humidity [10 marks]
7. The enthalpy
8. The wet bulb temperature
9. Dew point temperature
10. Specific volume of the dry air
11. What is your understanding of the term “Comfort Zone”. [4 marks]

**QUESTION THREE [20 MARKS]**

1. There are four fundamental shading strategies. Using a well annotated sketches, illustrate how these strategies can be used in design to achieve thermal comfort. [8 marks]
2. 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 thermal comforts. [9 marks]
3. (i) What is your understanding of passive solar cooling? [1 mark]

(ii) How does the use of “wing Walls” help in achieving passive cooling? [2 marks]

**QUESTION FOUR [20 MARKS]**

Urban climate refers to climatic condition in and around cities that differ from

the surrounding areas. This is attributed to urban development, which modifies

the form of the landscape as well as energy consumption between the urban

and natural rural environment. Write sort notes on Urban Heat Island,

explaining cause and mitigation factors thereof. [20 marks]