



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

**UNIVERSITY EXAMINATION FOR THE DEGREE IN SCIENCE IN RENEWABLE
ENERGY TECHNOLOGY AND MANAGEMENT**

4TH YEAR 1ST SEMESTER 2024/2025 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TEB 1409

COURSE TITLE: ENERGY AND BUILT ENVIRONMENT

EXAM VENUE:

STREAM: BSc. REN ENGY TEC & MGT

DATE: 8/1/2025

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 (COMPULSORY) (30 Marks)

- a. Define the following terms as used in energy and built environment.
 - i. Energy efficient building design. (1 Mark)
 - ii. Building envelope. (1 Mark)
- b. Figure 1 represents a building whose design encompasses energy efficiency principles. Examine and complete the building to encompass optimal energy efficiency strategies with respect to North-South orientation in a hot and dry environment in Bondo. (10 Marks)

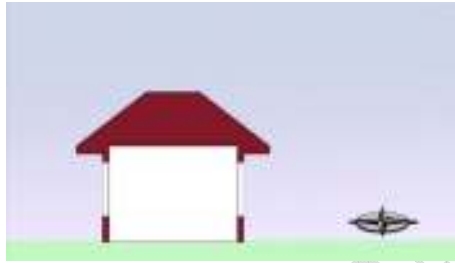


Figure 1. A building based on energy efficiency principles in Bondo.

- c. Passive solar energy efficient architectures are finding increased usage in contemporary buildings. Examine and show the significance of passive solar energy efficient architecture. (4 Marks)
- d. Examine three significant benefits of an energy efficient home in Bondo town. (3 Marks)
- e. Examine and show five strategies or ways to increase energy efficiency of a building? (5 Marks)
- f. Bondo County government in collaboration with the University management is planning to set-up a renewable energy demonstration laboratory in the County. Examine and outline three key design objectives of a whole building design to be considered by the stakeholders. (6 Marks)

QUESTION TWO (20 Marks)

- a. Using an illustration, show key steps of carrying out an energy audit of a commercial building in Bondo and recommend possible areas to encompass energy efficiency measures. (10 Marks)
- b. Examine and show key principles of Integrated Building Concept (IBC) with focus on Energy and Environmental of an upcoming net zero four-storey commercial building in Bondo town. (10 Marks)

QUESTION THREE (20 Marks)

- a. The need to focus on the sustainability of built environment exists in both developed and developing countries. Examine triple bottom line goals that buildings and building efficiency have significant impact on. (6 Marks)

- b. Compare and contrast solar house concept and adaptive building concept as used in energy and built environment. (4 Marks)
- c. The upcoming University administration block in Bondo, incorporated various design criteria from experts such as architects, mechanical/electrical/energy engineers to ensure optimal energy performance. Examine criteria used with respect to:
 - i. Site and building orientation. (4 Marks)
 - ii. Envelope and face design. (3 Marks)
 - iii. Daylight and lighting analysis. (3 Marks)

QUESTION FOUR (20 Marks)

- a. Show that to increase energy conversion efficiency, you need to reduce energy loss. (1 Mark)
- b. In the recent past, most commercial buildings are taking measures to reduce energy consumption. The most common measure is known as Optimization. Using illustrations, examine three optimization control measures commonly used. (6 Marks)
- c. Using an illustration, examine intelligent lighting control system in a typical building in Kenya. Clearly explain the function (s) of lighting system components in the system. (8 Marks)
- d. Examine the most energy efficient building materials in Kenya. (5 Marks)

QUESTION FIVE (20 Marks)

- a. Figure 2 below illustrates an energy efficient building. Examine labelled parts A and B and show their significance (2 Marks)

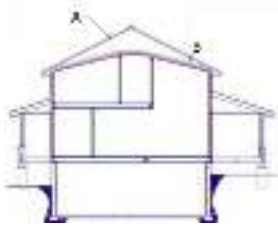


Figure 2. An energy efficient building.

- b. In building and designing an affordable zero energy homes (net zero homes), there are several integrated steps that utilize commonly available building materials and equipment. Examine four steps to be considered in building a net zero home. (4 Marks)
- c. Recently, Mars Wrigley Kenya factory in Machakos was feted with Leadership in Energy and Environmental Design (LEED) certification status. Examine five strategies and practices adopted by the factory in its design and construction to realize the award. (10 Marks)
- d. Examine four principles of an energy efficient building system at the University in Bondo. (4 Marks)