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

1ST YEAR 1ST SEMESTER 2024/2025 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TEB 1101

COURSE TITLE: INTRODUCTION TO RENEWABLE ENERGY AND MANAGEMENT

EXAM VENUE: MAIN CAMPUS **STREAM: BSc. REN ENGY TEC & MGT**

DATE: 13/1/2025 **EXAM SESSION:14-16.00 PM**

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) Name and define the two major divisions of Energy on Earth or around you **(4 Marks)**
b) Identify the SIX principles of renewable energy supply; define and explain two of these principles. **(6 Marks)**
c) Thus, with your understanding of the two divisions in a), fill in the spaces left in the table below in their comparisons **(20 Marks)**

COMPARISON OF RENEWABLEAND CONVENTIONAL ENERGY SYSTEMS			
NO	Item	Renewable energy supplies	Conventional energy supplies
1	Name other Terminologies	-	-
2	Give four Examples for Each	-	-
3	State the Source	-	-
4	What is the Normal state of existence	-	-
5	What is the Lifetime of supply of the energy	-	-
6	State word (s) for Cost at source	-	-
7	Location for use	-	-
8	Which Scale is common and affordable (Small, Moderate and large)	-	-
9	Safety	-	-
10	Give two examples each for Pollution and environmental damage	-	-

QUESTION TWO

The spectral distribution of the solar irradiance (solar short-wave radiation) at the Earth's mean distance originates from the nuclear fusion at the core of the sun. This passes through the Earth's atmosphere and a set of interactions do occur.

a) Explain with an aid of a diagram the term direct and diffuse beams. **(5 Marks)**
b) The solar short wave and the atmospheric long wave spectral distributions are divided into regions or limits that helps in explaining the important absorption processes. Name the five divisions and explain any two of the five divisions **(9 Marks)**
c) Expound on the Terms Green House effect and Reflection of the extraterrestrial solar intensity **(6 Marks)**

QUESTION THREE

The geothermal energy normally comes from down the depth of the earth to the land surface as a function of temperature. In the scenario;

a) Sketch a section down through depth of the earth showing i) section names ii) depth of the layers iii) and average temperature of the sections (**7 Marks)**

b) Name the known region(s) where i) the energy is harnessed ii) geothermal energy turbines are mostly embedded iii) hot springs or spars are likely to be found or located iv) likely the region where your sub -county falls in (name your sub-county) **(5 Marks)**

c) In b(i) the regions further have classes; i) name the three classes ii) and explain for each class how the energy is normally extracted at the surface of the earth **(8 Marks)**

QUESTION FOUR

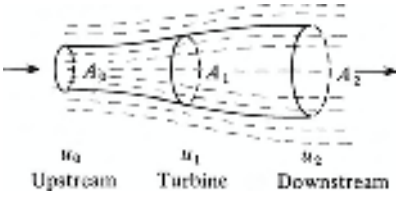
a) Define the term quality of an energy supply or store; give an example each of high and low conversion. **(4. 5 Marks)**

b) State the conversion power relationship of the following primary energy sources; Direct sunshine, Diffuse sunshine, Biofuels, Wind, Wave, Hydro, Tidal and Ocean thermal energy; **(8 Marks)**

c) Name and explain the three major types or divisions of renewable energy supply systems **(7.5 Marks)**

QUESTION FIVE

5a) Given the Betz model (below) of an expanding air stream and the equation:
$F = \dot{m} u_O - \dot{m} u_2$; where $\dot{m} = mass\ flow\ rate$, u_O / u_2 are respectively velocities at upstream and downstream of the model. The airstream velocity is constant and has a laminar flow. In four steps; show that $u_1 = 0.5\ (u_{O+} u_{2)}$ **(8 Marks)**



5b). A hydraulic ram is an example of a hydropower device used mostly in remote rural areas; Sketch the device and explain chronologically at least the first five steps of its operation principle **(12 Marks)**