JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMINATIONS FOR THE DEGREE IN SCIENCE IN RENEWABLE ENERGY TECHNOLOGY AND MANAGENT

3RD YEAR 1ST SEMESTER 2017/2018 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TET 3316

COURSE TITLE: BIOMASS ENERGY

EXAM VENUE: WS **STREAM: BSc REN ENERGY TECH & MGT**

DATE: 12/12/2017 **EXAM SESSION: 2.00 – 4.00 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 (COMPULSORY)

a. Define the term biomass (1 marks)
b. Biomass as a renewable energy resource is regarded as carbon neutral. Explain (2 marks)
c. According to the Ministry of Energy and Petroleum, wood fuel demand is linearly increasing at 2.7% per year while the sustainable supply increases at a paltry 0.6% per year. Based on this context, discuss measures or strategies to be adopted to ensure sustainable wood fuel production in Kenya. (10 marks)
d. In stove design, improving combustion in terms of less harmful pollution, higher efficiencies is a priority. Discuss how to address them in your stove design. (10 marks)
e. In stove design process, several misconceptions happen to be advanced. State and explain at least three major such misconceptions. (3 marks)
f. The composition of a fuel is often expressed on different bases depending on the situation. State and explain four bases of analysis commonly used in biomass energy composition (4 marks)

QUESTION TWO

a. Classification is an important means of assessing the properties of a fuel. Using illustrations, discuss the three methods of classifying biomass fuels. (9 marks)
b. Wood fuel is a major form of biomass energy contributing about 70% of the National energy demand in Kenya. Discuss (7 marks)
c. State and explain four characteristic densities. (4 marks)

QUESTION THREE

Give a detailed step by step procedure of carrying out a field water boiling test (WBT). (20 marks)

QUESTION FOUR

a. Major goal for any stove design is to get more heat into the pot (improve fuel efficiency). As an upcoming stove design expert, discuss how to improve stove fuel efficiency. (10 marks)
b. Bondo County community-based group would like to design a specific stove for household use. Discuss ten principles the group needs to be conversant with before beginning the design process. (10 marks)

QUESTION FIVE

a. Biomass is a complex mixture of organic materials such as proteins, fats, carbohydrates and other minerals. State and explain the main components in biomass (6 marks)
b. Biomass comes from a variety of sources. List the two major groups of biomass and their sub classifications (3 marks)
c. Biomass energy utilization comes with adverse environmental and social implications. Discuss (8 marks)
d. Thermal design of a biomass utilization system such a stove, a gasifier necessarily needs the composition of the fuel as well as its energy content. Ultimate and proximate analyses being the primary properties to describe fuel composition and energy content, discuss what the properties entail. (3 marks)