



**JARAMOGI OGINGA ODONGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

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

**3<sup>RD</sup> YEAR 1<sup>ST</sup> SEMESTER 2018/2019 ACADEMIC YEAR**

**CENTRE: MAIN CAMPUS**

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**COURSE CODE: TET 3316**

**COURSE TITLE: BIOMASS ENERGY**

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

**DATE: ../12/2018 EXAM SESSION:**

**DURATION: 2 HOURS**

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### **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. Biomass energy is a versatile energy source. Explain these statement (2 marks)
- d. Briefly describe how modern biomass differs from traditional biomass. (3 marks)
- e. According to the Ministry of Energy and Petroleum, woodfuel 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 at least three measures or strategies to be adopted to ensure sustainable woodfuel production in Kenya. (6 marks)
- f. Briefly discuss direct co-firing as the most commonly applied and lowest-cost concept for partially replacing coal or other solid fuels with biomass. (3 marks)
- g. 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)
- h. State at least three major misconceptions during stove design (3 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. Woodfuel is a major form of biomass energy contributing about 70% of the National energy demand in Kenya. Discuss (11 marks)

### **QUESTION THREE**

- a. Pellets are another form of biomass energy. Define the term pellet and explain how pellet is a bioenergy source. (3 marks)
- b. Briefly describe the indirect co-firing technology. (2 marks)
- c. Give a detailed step by step procedure of carrying out a field water boiling test (WBT). (15 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 the fuel efficiency being developed by a villager in Bondo County. (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)