



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DEGREE 04

EMG 2507: NEW AND RENEWABLE ENERGY RESOURCES

END OF SEMESTER EXAMINATION

SERIES: DECEMBER2016

TIME: 2HOURS

DATE: Pick Date Dec2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

Do not write on the question paper.

Question One

- With the aid of a sketch, explain the hydrological cycle. (4mks)
- List **THREE** factors to consider when designing a hydropower plant. (3mks)
- With the aid of a well labeled diagram, discuss the concept of power generation in a hydropower plant.
(8mks)
- The capacity of Kindaruma hydroelectric power station is 72MW. Given that the flow rate is $5\text{m}^3/\text{s}$, calculate the gross head. (5mks)

Question Two

- a) Discuss THREE feasibility factors to consider when designing a wind energy project (6mks)
- b) Using a well labeled diagram name the components of a wind turbine and explain their functions (8mks)
- c) Show that the theoretical power generated by a wind turbine is given by the following formula (6mks)

$$\text{Power} = \frac{1}{2} (\rho) (A) (V)^3$$

Question Three

- a) With the aid of a well labeled diagram explain the principles of biogas production (6mks)
- b) Define the following terms as used in biofuels
 - i. Saccharification
 - ii. Transesterification (4mks)
- c) Discuss the best type of crops for use in bioethanol production (4mks)
- d) Explain manufacturing process of bioethanol using appropriate equations (6mks)

Question Four

- a) With the aid of a well labeled diagram discuss the principle of power generation using heated steam from underground

(10mks)
- b) Explain the different methods of storing renewable energy giving details of the types of storage devices.

(10mks)

Question Five

- a) With the aid of a well labeled diagram and using the principle of the (p-n junction), explain how a solar cell converts the energy of light directly into electricity (DC) (5mks)
- b) Discuss the following types of solar power systems (6mks)
 - i. Grid Inter-tied Residential Solar Power System with Battery Backup
 - ii. Off Grid Solar Power Systems
 - iii. Hybrid Solar-Generator Systems
- c) Draw the layout of the following systems and name the components
 - i. Grid connected system
 - ii. Stand alone hybrid system (6mks)
- d) Name THREE types of solar PV modules (3mks)