



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

DEGREE BSME 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

- List **THREE** factors to consider when designing a hydropower plant. (3mks)
- Differentiate between impulse and reaction turbines (4mks)
- With the aid of a well labeled diagram, discuss power generation in a hydropower plant. (8mks)
- The capacity of Kamburu hydroelectric power station is 93MW. Given that the flow rate is $5\text{m}^3/\text{s}$, calculate the gross head. (5mks)

Question Two

a) Define the following terms as used in wind power generation

Cut-in speed

Rated speed

Cut-out speed (6mks)

b) Discuss the following types of turbines

Drag design

Lift design (4mks)

c) Using a well labeled diagram explain the generation of electricity using a wind turbine (6mks)

d) How much power a wind turbine with 60 meters long blade can generate with a wind speed of 12 m/s?

The site of the installation is about 1000 feet above sea level. Assume a standard Betz Limit.

$\rho = 1.16 \text{ kg/m}^3$, at 1000 feet (4mks)

Question Three

a) With the aid of a well labeled diagram explain the principles of biogas production (6mks)

b) Explain the effects of temperature in the production of biogas (4mks)

c) List two non food crops used for the production of each of the following biofuels

i. Bioethanol

ii. Biodiesel (4mks)

d) Explain the stages of Bioethanol production 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)