TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG 2507 : NEW & RENEWABLE ENERGY SOURCES

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: May 2016

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 question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE (COMPULSORY**) (30 Marks)**

a) State any FOUR advantages of solar energy. [**4 marks**]

b) With the aid of a diagram explain the working mechanism of a silicon solar cell. [**5 marks**]

c) Explain FIVE factors considered while locating the site for wind turbine **[5marks]**

d) Explain the following hydraulic turbines and name TWO examples:

i) Reaction turbines [**3 marks**]

ii) Impulse turbines [**3 marks**]

e) Differentiate between downdraft gasifiers and updraft gasifiers. [**4 marks**]

f) State at any TWO advantages and TWO disadvantages of wave energy. [**4 marks**]

g) Explain why the first stage of development of a geothermal plant begins with exploration. [**2 marks**]

Question Two (20 Marks)

a) Explain the Parabolic trough concentrating thermal collector

[**4 marks**]

b) Illustrate using a diagram an active indirect solar water heater. [**5 marks**]

c) A 1.2 m^2 solar collector has a heat loss coefficient of 5.0 $W/m^2\,^0C$ and absorber ambient temperatures of 50 ^0C and 30 ^0C respectively. Determine the thermal losses from the collector

[**3 marks**]

d) Diagrammatically illustrate a wind turbine naming all components

[5 marks]

e) Determine the speed of wind at 40 metres off the ground if the speed of wind at the same location at 10metres off the ground is 7metres/second and the height exponent is 0.16

[3 marks]

Question Three (20 Marks)

a) Explain how to identify possible areas with geothermal energy for exploration

[3 marks]

b) With the aid of a diagram explain the working principle of the binary cycle geothermal power plant.

[10 marks]

c) An impulse turbine develops 4500 kW at a head of 200 m. The turbine runner has a speed of 200 rpm discharges 0.8 m^3/s. If the head on the same turbine falls during dry season to 184.3 m, determine the new discharge, power and the speed of the turbine.

[**7 marks**]

Question Four (20 Marks)

a) Define unit discharge of a hydraulic turbine

[**2 marks**]

b) For a hydraulic turbine show that $Qu = \frac{Q}{\sqrt{H}}$ where Q_u is the unit discharge, Q and H are the discharge and head of the turbine.

[**5 marks**]

c) Compare and contrast the horizontal axis wind turbines (HAWT) and the vertical axis wind turbine (VAWT)

[**6marks**]

d)

i) Define solar irradiance

[**1 marks**]

ii) Explain the TWO types of crystalline silicon technologies.

[**6marks**]

Question Five (20 Marks)

a) List any FOUR disadvantages of tidal energy.

[**4 marks**]

b) Explain with the aid of a diagram the pendulor wave-power device.

[**6 marks**]

c) Explain the following in reference to biomass

i) Gasification

[**5 marks**]

ii) Pyrolysis

[**5 marks**]