KISII ⟨FONS SCIENTIAE⟩ UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF THE
DEGREE OF BACHELOR OF SCIENCE IN PHYSICS
FIRST SEMESTER 2022/2023
[SEPTEMBER-DECEMBER, 2022]

PHRE 312: WIND ENERGY I

STREAM: Y3S1   **TIME: 2 HOURS**

DAY: FRIDAY, 12:00 – 2:00 PM   **DATE: 23/12/2022**

INSTRUCTIONS

1. *Do not write anything on this question paper.*
2. *Answer question ONE and any other TWO questions.*

QUESTION ONE [30 MARKS]

a. It may be arguably said that wind power is a byproduct of solar energy: Explain this in details   [4 Marks]

b. What are all the forces acting on wind turbine blades?   [4 Marks]

c. Explain the advantages and disadvantages of any types of vertical axis wind turbines?   [5 Marks]

d. Describe the advantages and disadvantages of wind energy.   [4 Marks]

e. Write short notes on potential of wind power in Kenya highlighting steps made so far.   [5 Marks]

f. What are the factors responsible for distribution of wind energy on the surface of earth?   [3 Marks]

g. What is micro siting   [2 Marks]

h. Because of the Coriolis effect in the Northern Hemisphere, winds traveling north curve to the east and winds traveling south curve to the west. Explain this.   [3 Marks]

QUESTION TWO [20 MARKS]

a. What is Betz limit? Derive an expression for it?   [12 Marks]

b. Give two types of wind and elaborate each in detail explaining their subgroups
[8 Marks]

QUESTION THREE [20 MARKS]

a. You have been hired as a consultant to consult for Blue sea energy. One of the assignment is to explain to locals what happens in wind energy generation. Using a layman's language, explain how the company will go about harnessing wind power and explain measurement techniques.
[6 Marks]

b. What are the most favourable sites for installing of wind turbines?
[4 Marks]

c. What is the power per unit area of a 10 knot uniform wind (in W/m 2)?
[4 Marks]

d. Explain with a neat diagram a wind electric generating power plant.
[6 Marks]

QUESTION FOUR [20 MARKS]

a. Explain the working principle of horizontal axis wind mill with suitable diagrams.   [8 Marks]

b. The friction coefficient on the surface of the sea is f = 0.21. What is the shear stress produced by a wind of 12 knots?   [7 Marks]

c. How do you control the operation of wind mill? Explain its mechanism.
[5 Marks]

QUESTION FIVE [20 MARKS]

a. Describe the main considerations in selecting a site for wind generators.
[5 Marks]

b. Determine the most probable velocity and most probable power of a Rayleigh wind velocity distribution with Vm = 28 mph.   [7 Marks]

c. Derive the expression for power developed due to wind.   [8 Marks]