KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF
THE DEGREE OF BACHELOR OF SCIENCE (RENEWABLE ENERGY)

SECOND SEMESTER 2021/2022
(FEBRUARY – JUNE, 2022)

PHRE 322: OTHER RENEWABLE ENERGY SOURCES I

STREAM: Y3 S2 **TIME: 2 HOURS**

DAY: TUESDAY, 3:00 PM – 5:00 PM **DATE: 25/05/2022**

INSTRUCTIONS

1. ***Do not write anything on this question paper.***
2. ***Answer Question ONE and any other TWO questions.***
3. ***Question one carries 30 marks while the other carry 20 marks.***

QUESTION ONE

a. The nuclear contains neutrons and protons. It is said; Like charges repel and unlike attract. Explain the charges of the nuclear. How do these exist considering, neutron – neutron, neutron – proton and proton – proton forces. [9 marks]

b. Assuming that the energy released per fission of $^{235}_{92}$ U is 200 MeV, calculate the number of fission processes that should occur per second in a nuclear reactor to operate at a power level of 20,000 kW. What is the corresponding rate of consumption of $^{235}_{92}$U. [5 marks]

c. You have been appointed to head and chair the nuclear and hydrogen task force by the ministry of energy. Your task is to come up with the viability and safety of implementing the projects. Discuss the viability of both, highlighting their safety concerns [10 marks]

d. Give properties of hydrogen that make it attractive to be used as a fuel. [6 marks]

QUESTION TWO

a. Hydrogen as an energy carrier can be converted into useful forms of energy in several ways. List 5 ways [5 marks]
b. Chose any 3 methods listed above and explain them in details [15 marks]

QUESTION THREE

a. Estimate the energy released in fission of $^{238}_{92}$ U nucleus, given a_c = 0.59 MeV and a_s = 14.0 MeV. [5 marks]
b. Give types of nuclear wastes and the risks associated with them[5 marks]
c. Explain the hydrogen thermochemical process, as a production method, detailing the three cycles [10 marks]

QUESTION FOUR

a. Assume that in each fission of ^{235}U, 200 MeV is released. Assuming that 5% of the energy is wasted in neutrinos, calculate the amount of ^{235}U burned which would be necessary to supply at 30% efficiency, the whole annual electricity consumption in Kenya 50×10^9 kWh [7 marks]
b. A thermal reactor contains 100 tons of natural uranium (density 19) and operates at a power of 100 MW (heat). Assuming that the thermal cross-section of ^{235}U is 550 barns and that the uranium contains 0.7 % of ^{235}U. Calculate the neutron flux near the centre of the reactor by neglecting neutron losses from the outside, and assuming flux constant throughout the lattice. [7 marks]
c. Assuming the energy released per fission of ^{235}U is 200 MeV, calculate the amount of ^{235}U consumed per day in Canada India reactor “Cirus” operating at 40 MW of power. [6 marks]

QUESTION FIVE

a. The disintegration rate of a radioactive source was measured at intervals of four minutes. The rate was found to be (in arbitrary units) 18.59, 13.27, 10.68, 9.34, 8.55, 8.03, 7.63, 7.30, 6.99, 6.71, and 6.44. Assuming that the source contained only one or two types of radio nucleus, calculate the half lives involved. [10 marks]

b. List and explain, in details, three methods as to how hydrogen can be stored [10 marks]