COURSE CODE: PHY457
COURSE TITLE: ENVIRONMENTAL PHYSICS
CREDIT UNIT: 3
TIME ALLOWED: (3 HRS)
INSTRUCTION: *Answer question 1 and any other three questions*

QUESTION 1

(A)   Explain the term Environmental Pollution   (3 marks)
(B)   List and describe three primary types of energy resources.   (9 marks)
(C)   i. List the five distinct components of the planet Earth.   (5 marks)
        ii. Write short note on any 2 of the components of the earth.   (4 marks)
(D)   Briefly describe how perturbations affect satellite motion in a many-body system. (4 marks)

QUESTION 2

(A) From the hydrostatic equation, derive the equation to show how pressure diminishes with height.
                                                                            (8 marks)
(B) i. Calculate the maximum possible efficiency of a Carnot engine operating between two thermal
        reservoirs at high temperature 500K and low temperature 300K.   (5 marks)
    ii. What happens to the efficiency when both temperatures approach same value? (2 marks)

QUESTION 3

(A) i. State 5 properties in which the terrestrial atmosphere is characterized   (5 marks)
    ii. Estimate the limit of the adiabatic atmosphere, given the ratio of the specific heat   capacities to be
       1.4. Take P = 1.01 x 10^5 Nm^{-2}, ρ = 1.23 kg/m^3 and g = 9.81 m/s^2 (4 marks)
(B) State 3 environmental problems affecting the earth   (6 marks)

QUESTION 4

(A) Discuss the role of artificial satellites in environmental monitoring.   (4 marks)
(B) Explain the concept of satellite orbits in a two-body system and cite examples   (6 marks)
(C) Discuss how satellite motion is affected in a many-body system and cite an example (5 marks)

QUESTION 5

(A) i. Given the initial velocity v_0 5000 m/s of a satellite when it is at a distance r_0 10,000 km, from the Earth's center, calculate the satellite's velocity v_1 at the distance r_1 15,000 km from the Earth's center.
Take $G = 6.67 \ x \ 10^{-11} N.\frac{m^2}{Kg^2}, M = 5.97 \ x \ 10^{24} Kg$ (8 marks)
(B) i. Explain the implication of the answer gotten above in Ai.   (3 marks)
 ii. Explain why the mass of the satellite *m* does not appear in the equation when applying the conservation of mechanical energy to solve for the satellite's velocity at a different point in its orbit.
                                                                            (4 marks)

QUESTION 6

(A) Define remote sensing and state its applications in environmental physics.   (6 marks)
(B) Describe 3 challenges associated with the large-scale adoption of renewable energy. (3 marks)
(C) List three key instruments used in satellite remote sensing and their functions. (6 marks)