MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF PHYSICAL SCIENCES

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION (SCIENCE)

SPH 350: PRINCIPLES OF ENVIRONMENTAL PHYSICS

DATE: 9 / 8/ 2016 **TIME: 2.00 – 4.00 PM**

INSTRUCTIONS:

Answer question **ONE** which is compulsory and any other **TWO**

Take Relative biological Equivalent (RBE) for gamma and beta as 1,

and 20 for alpha particles,

QUESTION ONE.

a) Distinguish between x-rays and gamma rays (2 marks)

b) Define the intensity of sound referred to as threshold of pain (2 marks)

c) Find the intensity level of sound with intensity of 2.4×10^{-6} W/m^2 (4 marks)

d) Explain the principle behind instruments used to detect ionization of radiations.
Radiations like gamma rays (2 marks)

e) Describe two ways in each case on how radiations
i) cause damage to human body (4 marks)
ii) Can be used to our advantage (4 marks)

f) Name some two areas of a human body which are
i) Very sensitive and (4 marks)

ii) Less sensitive to ionizing radiations (4 marks)

g) Name two factors which determine the magnitude of biological effects of radiation (4 marks)

QUESTION TWO

a) Given that I_1 and I_2 are the intensities of sound from two point sources at a distance R_1 and R_2 respectively, show that $\frac{I_2}{I_1} = \frac{R_1^2}{R_2^2}$ (5 marks)

b) A factory emits about 800 W of energy as sound waves. What is the sound intensity level in a village 2 km away (6 marks)

c) In a geothermal field three wells are being discharged into the atmosphere. The wells produce sounds of 4.0 x 10^7W, 12.0 x 10^6W and 1.6 x 10^4W respectively. Find the intensity level of sound they exert onto a nearby hospital 2 km away. (9 marks)

QUESTION THREE

a) Some three machines crushing rocks and grinding metals are running near a hospital producing 60dB, 120dB and 80dB respectively.

i) Calculate the combined intensity level of sound as received in the hospital. (9 marks)

ii) If the hospital is 1 km from the factories, calculate the sound power generated by the factory with 120 dB. (3 marks)

b) Give a reason why geothermal energy is referred as to as renewable energy (2 marks)

c) Distinguish between binary and ordinary geothermal power plants using a well labeled diagrams (6 marks)

QUESTION FOUR

a) Explain what is meant by the phrase "Dry rock" in geothermal context (3 marks)

b) A person working in a nuclear electricity power plant in Japan is exposed to 4.1 mSv of radiation type gamma $^{99}T_c$.

i) What is the total energy deposited on the workers body in Joules and in electron volts (eV) if his mass is 70 kg? (9 marks)

ii) Discuss if this energy is enough to cause enough tissue damage (4 marks)

c) Draw an electromagnetic spectrum and clearly show the position of gamma and x-rays (4 marks)

QUESTION FIVE

a) Gamma rays with energies of 3.0×10^{12}eV are occasionally observed from distant astrophysical sources. What are their wavelengths and frequencies (6 marks)

b) An animal swallows a radioactive isotope which provides a dose of 0.20 Gy. Which type of radiation will give the highest dose equivalent in mSv among gamma, beta and alpha? (9 marks)

c) A nuclear plant worker is exposed to 3 mJ of neutron radiation and receives a dose of 3 mSv. Calculate the RBE of the neutron radiation. (5 marks)