MACHAKOS UNIVERSITY

UNIVERSITY EXAMINATIONS 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF PHYSICAL SCIENCES

THIRD YEAR FIRST SEMESTER SPECIAL/SUPPLEMENTARY

EXAMINATION FOR BACHELOR OF EDUCATION (SCIENCE)

SPH 350: PRINCIPLES OF ENVIRONMENTAL PHYSICS

DATE: 24/9/2019 **TIME: 11:00 – 1:00 PM**

INSTRUCTIONS

Answer Question One And Any Other Two Questions

Take Relative biological Equivalent (RBE) for gamma and beta are 1 and 20 for alpha particles,

1.

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

b) 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)

c) 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)

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

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

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

g) Explain the principle behind instruments used to detect ionization radiations like gamma rays (2 marks)

2. a) 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)

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

c) Find the intensity level of sound with intensity of 2.4×10^{-6}W/m^2 (5 marks)

3.

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) 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)

4. Derive the differential form of the continuity equation (20 marks)

5. a) 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)

b) Name some two areas of a human body which are

i) very sensitive and (4 marks)

ii) Less sensitive to ionizing radiations have (4 marks)

iii) Name three factors which determine the magnitude of biological effects of radiation (3 marks)