

**DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY**

**University Examinations 2015/2016**

**FIRST YEAR SEMESTER II EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN**

**CIVIL ENGINEERING, MACHATRONICS ENGINEERING,**

**ELECTRICAL AND ELECTRONIC ENGINEERING, MECHANICAL ENGINEERING, GEOSPATIAL INFORMATION SCIENCE & GEOMATIC ENGINEERING & GEOSPATIAL INFORMATION SYSTEMS.**

**SPH 2171/: PHYSICS II/SPH 2174 PHYSICS FOR ENGINEERS II**

**DATE: 13TH APRIL 2016 TIME: 11AM-1PM**

**Some useful constants**

1. = 8.854x10-12 C2 /Nm2
2. Mass of proton = 1.0073 a.m.u
3. Mass of Neutron = 1.0087 a.m.u
4. 1 a.m.u = 931 M eV
5. h=6.626x10-34 Js
6. 1 a.m.u=1.66x10-27 Kg

**Instructions**

**Answers question one and any other two questions.**

**Question one (30 marks)**

1. Define the following terms
2. Drift velocity . (1 mark)
3. The potential(V). (1 mark)
4. Atom . (1 mark)
5. A parallel plate capacitor with a dielectric whose thickness is 0.15mm has a p.d of 60V applied across the arrangement. Calculate the electric field intensity between the plates .( 3 marks).
6. Outline how you can verify Ohm`s law ,giving all the circuit diagrams required.( 3 marks)
7. The resistance of a conductor at is 140Ω.If the temperature coefficient of resistance of the conductor at is 0.004264/,determine its resistance at ( 3marks)
8. State three factors that determine the force on a current carrying conductor in a magnetic field. ( 3 marks)
9. ( 4 marks)
10. Tritium is an unstable isotope of hydrogen if its 3.011a.m.u. Determine its binding energy. ( 3 marks)
11. Write an equation showing how a proton changes to a neutron. ( 2marks)
12. State three uses of radio activity. ( 3marks)
13. List three similarities between magnetic field lines and electric field lines ( 3marks)

**Question two (20 marks)**

(a) State

1. Kirchoff`s current law. ( 1mark)
2. Lenz`s law. ( 1 mark)
3. Farady`s laws of electromagnetic induction. ( 1 mark)

(b) (i) Show that the electric current through a cylindrical conductor is given by where all the symbols have their usual meaning. ( 5 marks)

(ii) A given electric bulb is labeled 100W 0.9A.Calculate the number of charges passing its cross-section in 1.5 hours. ( 3 marks)

(c) State three factors that affect resistance ( 3 marks)

(d) Determine the current through each of the resistors (6 marks)

20 ohms 15 ohms

4 ohms

60V

10 ohms

5 ohms OOOOHMOHMS ohms

12 ohms OOOOHMOHMS ohms

30 ohms

**Question three (20 marks)**

1. Show that for parallel plate capacitor with dielectric as free space is given as

where A is area of plate and d the plates separation distance. ( 5 marks)

1. Three charges, and are placed at the points (0,7) ,(10,0) and (-6,0) respectively. Calculate the electric field at the point (0,0), all units are in metres.( 5 marks)
2. State two uses of capacitors. ( 2 marks)
3. Three capacitors 3µF,6µF and 18µF are connected across a 20Vd.c in series .Calculate the total charge stored by the system. (4 marks)
4. Two capacitors C1 and C2 when connected in series results in a total capacitance of 2µF and while connected in parallel results in a total of capacitance of 9µF. Find the possible values of the two capacitors. ( 4 marks)

**Question four (20 marks** )

1. State two types of radioactivity. (2 marks)
2. The half-life of a certain element is Calculate its decay constant.(3 marks)
3. Write an equation for a general particle when it undergoes a beta decay. ( 3 marks)
4. Differentiate between nuclear fission and nuclear fusion. ( 2marks)
5. Sketch and explain a graph of Binding energy per nucleon against mass number. ( 4 marks)
6. Calculate the binding energy released in the following reaction

+ + ( 4 marks)

1. State two dangers of radioactive radiations. ( 2 marks)

**Question five (20 marks)**

1. State four properties of X-rays. (4 marks)
2. Determine the energy in electron volts of a photon having a wavelength of ( 3 marks)
3. An electron falls through a p.d of .Calculate
4. The energy given up by the electron. ( 3 marks)
5. The frequency of the electromagnetic radiation produced. ( 3 marks)
6. Differentiate between X-rays and Gamma rays. ( 2marks)
7. An X-ray of is incident on a target. Calculate
8. the wavelength of the scattered photon at ( 2 marks)
9. the energy of the scattered electron. ( 3 marks)