TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA MARINE ENGINEERING

EMR 2112 : MARINE ENGINEERING SCIENCE II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick Date May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt any THREE questions.

Do not write on the question paper.

Question ONE:

a) Define the following Electromagnetic Radiation terms: i) Wavelength
ii) Frequency
iii) Electromagnetic radiation
iv) Wavenumber **8 marks**

b) Calculate the frequency of electromagnetic radiation that has a wavelength of 1.315μm. Also find the frequency of infrared radiation of wavelength 67.5μm. **6 marks**

c) Write **(DO NOT DERIVE)** the four Maxwell's equations. **6 marks**

Question TWO:

a) Define the following Electrostatics terms:
i) Dielectric strength
ii) Electrostatic induction
iii) Permittivity
iv) Coulomb **8 marks**

b) Two point-like charges carrying charges of $+3x10^{-9}C$ and $-5x10^{-9}C$ are 2m apart. Determine the magnitude of the force between them and state whether it is attractive or repulsive. Take k= $8.99x10^{9}N.m^2/C^2$. **5 marks**

c) Determine the electrostatic force and gravitational force between two electrons 1 Aring apart (i.e the forces felt inside an atom). **7 marks**

Question THREE:

a) Define the following terms:
   i) Magnetic Flux
   ii) Magnetic Flux Density
   iii) Electromagnetism
   iv) Permeability **8 marks**

b) i) If the flux density in a certain magnetic material is 2.3 T and the area of the material is 0.38 in.", what is the flux through the material?
   ii) There are two amperes of current through a wire with 5 turns.
   (a) What is the mmf?
   (b) What is the reluctance of the circuit if the flux is 250 μWb? **12 marks**

Question FOUR:

a) Calculate the wavelengths of a 1530 kHz AM radio signal, a 105.1 MHz radio signal and a 1.90GHZ cell phone signal. **6 marks**

b) During laser vision correction, a brief burst of 193nm ultraviolet light is projected onto the cornea of a patient. It makes a spot 0.80mm in diameter and evaporates a layer of cornea 0.30μm thick. Calculate the energy absorbed, assuming the corneal tissue has the same properties as water, it is initially at 34^oC. Assume the evaporated tissue leaves at a temperature of 100^oC. **10 marks**

c) State any two applications of electromagnetic waves. **4 marks**

Question FIVE:

a) i) State the Principle of Conservation of Energy.
   ii) State the Principle of Conservation of Mechanical Energy. **4 marks**

b) In a horizontal pinball machine the spring is compressed 5cm. If the mass of the ball is 20g and the stiffness of the spring is $800Nm^{-}$, what is the speed of the ball when it leaves the spring assuming that friction can be neglected? **6 marks**

c) A particle of mass 3kg is acted upon by three forces, $F_1= i+ 2k$, $F_2= 3j + 4k$, and $F_3= 2i + 3j$. If the particle moves from the point i- j- k to 3(i+ j+ k), find the work done by the resultant. **10 marks**