



# 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  $1.315\mu\text{m}$ . Also find the frequency of infrared radiation of wavelength  $67.5\mu\text{m}$ . **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  $+3 \times 10^{-9} \text{C}$  and  $-5 \times 10^{-9} \text{C}$  are 2m apart. Determine the magnitude of the force between them and state whether it is attractive or repulsive. Take  $k = 8.99 \times 10^9 \text{N.m}^2/\text{C}^2$ . **5 marks**
- c) Determine the electrostatic force and gravitational force between two electrons 1 Å 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.<sup>2</sup>, 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°C. Assume the evaporated tissue leaves at a temperature of 100°C. **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<sup>-1</sup>, 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**