



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.², 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 0.30 μm 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 800N/m, 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**