



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

**DIPLOMA MARINE ENGINEERING**

**EMR 2112: MARINE ENGINEERING SCIENCE 2**

**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.**

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## **Question ONE:**

- a) Explain what simple machines are. **10 marks**
- b) Explain the working principles of the following simple machines:
- i) Lever
  - ii) Pulleys **10 marks**

## **Question TWO:**

- a) Briefly explain the following forms of Energy:
- i) Electrical Energy
  - ii) Chemical Energy
  - iii) Radiant Energy **10 marks**
- b) i) State the Lenz's law.
- ii) Explain the application of Electromagnetic induction by the use of a DC Generator. **10 marks**

**Question THREE:**

- a) A sinusoidal electromagnetic wave of frequency 40.0 MHz travels in free space in the  $x$  direction.
- i) Determine the wavelength and period of the wave.
  - ii) At some point and at some instant, the electric field has its maximum value of 750 N/C and is along the  $y$  axis. Calculate the magnitude and direction of the magnetic field at this position and time.
  - iii) Write expressions for the space–time variation of the components of the electric and magnetic fields for this wave. **12 marks**
- b)i) Define the term, Energy.
- ii) State the Principle of Conservation of Energy. **3 marks**
  - iii) In a horizontal pinball machine the spring is compressed 7cm. If the mass of the ball is 40g and the stiffness of the spring is  $870\text{Nm}^{-1}$ , what is the speed of the ball when it leaves the spring assuming that friction can be neglected? **5 marks**

**Question FOUR:**

- 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 FIVE:**

- a) Define the following simple machines terms:
- i) Work
  - ii) Load
  - iii) Effort
  - iv) Actual Mechanical Advantage **8 marks**
- b) Define the following Electromagnetic properties:
- i) Relative permeability
  - ii) Reluctance
  - iii) Magnetomotive Force (mmf)
  - iv) Magnetizing Force (H)
  - v) Electromagnetic Induction **10 marks**
- c) State Faraday's law of electromagnetic induction. **2 marks**