



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 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.

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.
- Determine the wavelength and period of the wave.
 - 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.
 - 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.
- State the Principle of Conservation of Energy. **3 marks**
 - 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 870Nm^{-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:
- Wavelength
 - Frequency
 - Electromagnetic radiation
 - 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:
- Work
 - Load
 - Effort
 - Actual Mechanical Advantage **8 marks**
- b) Define the following Electromagnetic properties:
- Relative permeability
 - Reluctance
 - Magnetomotive Force (mmf)
 - Magnetizing Force (H)
 - Electromagnetic Induction **10 marks**
- c) State Faraday's law of electromagnetic induction. **2 marks**