TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPOMA IN COMPUTER SCIENCE & INFORMATION TECHNOLOGY (DCIT J13)

APS 2130: FUNDAMENTALS OF PHYSICS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A** & **B**
Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question One

a) (i) State Newton's first Law of motion **(1 mark)**

(ii) Show that F = ma, when F is the force applied, m is the mass of the object and a the acceleration **(5 marks)**

(iii) A car of mass 1000kg is accelerating at $2ms^{-2}$. If the resistance to motion is 1000N, what is the force due to the engine? **(4 marks)**

b) (i) Explain how temperature affects the resistance of a conductor. **(2 marks)**

(ii) A $4\ \Omega$ and $6\ \Omega$ resistance are connected in parallel across a 6.0 volt battery having internal resistance of $0.6\ \Omega$.

(i) Draw the circuit diagram **(3 marks)**
(ii) What is the total current in the circuit **(5 marks)**

c) (i) Derive the dimensions of velocity **(2 marks)**
(ii) Use dimensional analysis to check the validity of the second equation of uniformly accelerated motion. **(3 marks)**

$$S = ut + \frac{1}{2}at^2$$

d) A wire length L = 2.35m and diameter d = 1.63mm carries a current I of 1.24A. The wire dissipates electrical energy at the rate of P of 48.5mW. Calculate:
(i) The resistance of the wire **(2 marks)**
(ii) The resistivity of the wire **(3 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) (i) Define the following terms:
(i) Displacement
(ii) Acceleration **(2 marks)**
(ii) Derive the three equations of uniformly accelerated motion **(8 marks)**

b) (i) Explain how the electric field intensity is indicated in the electric field patterns. **(4 marks)**

(ii) A charge of 2 μC placed in an electric field experiences a force of 0.08N. What is the magnitude of the electric field intensity? **(4 marks)**

c) Give **TWO** uses of reflecting surfaces **(2 marks)**

Question Three

a) Radio transmission is possible with certain spectrum of waves that travel through space at 3×10^8m/s.

(i) State **TWO** differences between radio waves and other types of radiation in the electromagnetic spectrum. **(2 marks)**
(ii) What is the frequency of the radio transmission of wavelength 1500m? **(3 marks)**
(iii) List **FIVE** properties of electromagnetic waves **(5 marks)**

b) A graph of input voltage against time (seconds) for an electronic signal:
(i) In analogue system **(2 marks)**
(ii) In digital system **(2 marks)**

c) Speech signals in the frequency range 300Hz to 3400Hz are used to amplitude modulate a carrier wave of frequency 200.0 kHz. Determine:
(i) The bandwidth **(3 marks)**
(ii) The frequency range of the lower and upper side bands **(3 marks)**

Question Four

a) Define the following terms:
(i) Energy
(ii) Power **(2 marks)**

b) What power is developed when a machine lifts a mass of 200kg vertically up to height of 20m in half a minute **(6 marks)**

c) Two resistors of 1200 Ω and 800 Ω are connected in series with a battery of e.m.f 24V and negligible internal resistance. What is the p.d. across each resistor? **(6 marks)**

d) (i) State the law of conservation of energy **(2 marks)**
(ii) Describe the energy transformation in hydro-electric power stations. **(4 marks)**

Question Five

a) State Coulomb's Law **(2 marks)**

b) A capacitor C of 0.1 μF is used on the main frequency of 50Hz. Calculate the reactance. **(4 marks)**

c) A car moving with a velocity of $10ms^{-1}$ accelerates uniformly at $2ms^{-2}$ until it reaches a velocity of $15ms^{-1}$. Calculate:

(i) The time taken **(2 marks)**

(ii) The distance travelled during the acceleration **(3 marks)**

(iii) The velocity reached 100m from the place where the acceleration began **(3 marks)**

d) State **THREE** uses of Lasers **(3 marks)**