JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN:

BUILDING AND CONSTRUCTION MANAGEMENT AND

RENEWABLE ENERGY

2018/2019 EXAMINATION

MAIN

REGULAR

COURSE CODE: SPH 3111

COURSE TITLE: PHYSICS 1

DATE: **EXAM SESSION:**

TIME: 2:00HRS

Instructions:

1. **Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**
   4. Take $h = 6.63 \times 10^{-31} js, m_e = 9.11$, Specific heat capacity of water is 42000Jkg^{-1}K^{-1}

QUESTION ONE

a) Define the following terms
   i. Impulse
   ii. Viscosity
   iii. Elastic limit
   iv. Thermal equilibrium   **(4 marks)**

b) A particle moves in one dimension. Its position of a function of time is given in SI units by $X_{(t)} = 2t^4 - 5t^2 + 18$. What is the average velocity between 2 seconds and 4 seconds?
                                                         (3 marks)

c) Find the cross product of the two vectors

$$\vec{A} = 2i + 3j + k$$
$$\vec{B} = -4i + 2j - k$$ **(4 marks)**

d) State the three conservation principles considered when deriving equations of ideal fluids
                                                         (3 marks)

e) A car travelling at 22.4m/s skids to stop in 2.55s. Determine the skidding distance of the car (assume uniform acceleration)   **(3 marks)**

f) State the first law of thermodynamics   **(1 mark)**

g) State three factors affecting photoelectric effect   **(3 marks)**

h) Two pipes, each of diameter d, converge to form a pipe of diameter D. What should be the relation between d and D such that the low velocity in the third pipe becomes half of that in eachof the two pipes?   **(3 marks)**

i) A block of iron of mass 1.25kg at $120\,^\circ C$ was transferred to a aluminum calorimeter of mass 0.3kg at $25\,^\circ C$. The block and the calorimeter with its contents eventually reached a common temperature of $50\,^\circ C$. Given the ;specific heat capacity of iron as $450JKg^{-1}K^{-1}$ and that of aluminum as $900JKg^{-1}K^{-1}$, calculate the specific heat capacity of the liquid.

                                                         (6 marks)

QUESTION TWO

a) (i) Derive the rectilinear equations using calculus **(6 marks)**

(ii) A mass of 1.5kg move in a circular path with a constant speed of 3ms-1 on a horizontal frictionless surface. The mass is held to the circular path by a light card 2.4m long that has one end fixed and the other end attached to the mass. Calculate the tension in the card

(**4 marks**)

(b) (i) Define the term surface tension **(2 marks)**

(ii) Discuss two types of elasticity stating their applications **(4 marks)**

(ii) List two factors affecting elasticity **(4 marks)**

QUESTION THREE

a) Discuss three modes of heat transfer   (**6 marks**)

b) Find the final temperature if a heater source rated 42W heats 50g of water from 20°C in five minutes.

(**8 marks**)

c) (i)An engineer is designing the runway of a airport, the lowest acceleration rate is likely to be $3m/s^2$ the take off speed for this plane will be 65m/s. assuming this minimum acceleration, what is the minimum allowed length for the runway?

(**3 marks**)

(ii) The observation deck of tall skyscraper 370m above the street. Determine the time required for the penny to free fall from the deck to the street below?   (**3 marks**)

QUESTION FOUR

a) Vectors $\vec{a}$ and $\vec{b}$ are given as follows

$$\vec{a} = (4, 6, 8) \quad\quad \text{and} \quad\quad \vec{b} = (6, 8, 10)$$

      i.   Find $\vec{a} \times \vec{b}$ **(6 marks)**

      ii.   Find the angle between them   **(5 marks)**

b) Considering a vertical projection, derive the equation for;

      i.   Time taken by a body to reach maximum height
      ii.   Time of flight
      iii. Maximum height reached   **(9 marks)**

QUESTION FIVE

a) (i) State the Stefan's law **(1 mark)**

(ii) State three factors affecting sound velocity **(3marks)**

(iii) Sound from source A has twice the frequency of sound from Source B. Compare the wavelengths of sound from the two sources **(3 marks)**

b) (i) Derive Stoke's equation defining the terms **(5 marks)**

(ii) Two pipes of diameters d1 and d2 converge to form a pipe of diameter 2d. If the liquid flows with a velocity of v1 and v2 in the two pipes, what will be the flow velocity in the third pipe? **(3 marks)**

c) Discuss three applications of ultrasonic sound **(6 marks)**