



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 $h = 6.63 \times 10^{-34} \text{ Js}$, $m_e = 9.11 \times 10^{-31} \text{ kg}$, Specific heat capacity of water is $4200 \text{ J kg}^{-1} \text{ K}^{-1}$**

QUESTION ONE

- a) Define the following terms
- Impulse
 - Viscosity
 - Elastic limit
 - Thermal equilibrium
- (4 marks)
- b) A particle moves in one dimension. Its position as 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
- $$\begin{aligned}\vec{A} &= 2\mathbf{i} + 3\mathbf{j} + \mathbf{k} \\ \vec{B} &= -4\mathbf{i} + 2\mathbf{j} - \mathbf{k}\end{aligned}$$
- (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 2.5s. 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 diameters d , converge to form a pipe of diameter D . What should be the relation between d and D such that the flow velocity in the third pipe becomes half of that in each of the two pipes?
- (3 marks)
- i) A block of iron of mass 1.25kg at 120°C was transferred to a aluminum calorimeter of mass 0.3kg at 25°C. The block and the calorimeter with its contents eventually reached a common temperature of 50°C. Given the specific heat capacity of iron as $450\text{JKg}^{-1}\text{K}^{-1}$ and that of aluminum as $900\text{JKg}^{-1}\text{K}^{-1}$, 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 an 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
 $\vec{a} = (4, 6, 8)$ and $\vec{b} = (6, 8, 10)$
- 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 three factors affecting sound velocity (3marks)
 - (ii) 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 d_1 and d_2 converge to form a pipe of diameter $2d$. If the liquid flows with a velocity of v_1 and v_2 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)