CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF CERTIFICATE IN COMPUTER SCIENCE

PHYS 00111: FUNDAMENTALS OF PHYSICS

STREAMS: CERT(COMP SCI) **TIME: 2 HOURS**

DAY/DATE: FRIDAY 14/12/2018 **8.30 A.M - 10.30 A.M.**

INSTRUCTIONS:

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Take;

$g = 9.8ms^{-2}$
$c = 3. X 10^8 m/s$

QUESTION ONE

a. Define the following terms. [3Marks]
   (i) Inertia
   (ii) Displacement
   (iii) Power

b. Differentiate between basic physical quantities and derived quantities stating specific examples [3 Marks]

c. A motor car is uniformly retarded and brought to rest from a speed of 180km/hr in 15 sec. find its acceleration. [3 Marks]

d. Differentiate between mass and weight stating the instruments used to measure them [3 Marks]

e. List the six types of simple machines [3 Marks]

f. (i) Define a force and state its SI unit [2 Marks]

   (ii) What are the three states of static equilibrium? [3 Marks]

g. Define the following terms
   (i) Power and state its SI units [2 Marks]
   (ii) Mechanical advantage [1 Marks]
   (iii) Velocity ratio [1 Mark]
   (iv) Efficiency [1 Mark]

h. State the laws of reflection [3 Marks]
i. What is the dual nature of light? [2 Marks]

QUESTION TWO

a) Using the examples of work and torque respectively, differentiate between dot and cross products giving their mathematical equations and describing their resultants. [6 Marks]

b) Explain what is meant by a null vector, an equal vector and a negative vector. [3 Marks]

c) What is the magnitude of a vector? Hence, find the magnitude of $-4\mathbf{i} + 6\mathbf{j} + \mathbf{k}$ [3 Marks]

d) Compute the scalar and vector products of $2\mathbf{i} + 6\mathbf{j} - 4\mathbf{k}$ and $4\mathbf{i} - 7\mathbf{j} - 9\mathbf{k}$ [8 Marks]

QUESTION THREE

a) State the three Newton laws of motion . [3 Marks]

b) Show that F=ma [5 Marks]

c) A worker with spikes on his shoes pulls with a constant horizontal force of magnitude 20 N on a box of mass 40 kg resting on the flat, frictionless surface of a frozen lake. What is the acceleration of the box ? [4 Marks]

d) The masses of the javelin, discus, and shot are 0.80 kg, 2.0 kg, and 7.2 kg, respectively, and record throws in the corresponding track events are about 98 m, 74 m, and 23 m, respectively. Neglecting air resistance, (i) calculate the minimum initial kinetic energies that would produce these throws, and (ii) estimate the average force exerted on each object during the throw, assuming the force acts over a distance of 2.0 m. [8 Marks]

QUESTION FOUR

a) Define work and energy and state their respective SI units [4 Marks]

b) Determine the work done when a force of 50 N pushes an object 1.5 km in the same direction as the force. [3 Marks]

c) A constant force of 2kN pulls a crate along a level floor a distance of 10 m in 50s.What is the power used? [5 Marks]

d) An indestructible bullet 2.00 cm long is fired straight through a board that is 10.0 cm thick. The bullet strikes the board with a speed of 420 m/s and emerges with a speed of 280 m/s. (i) What is the average acceleration of the bullet through the board? (ii) What is the total time that the bullet is in contact with the board? (iii) What thickness of board (calculated to 0.1 cm) would it take to stop the bullet, assuming that the acceleration through all boards is the same? [8 Marks]

QUESTION FIVE

a) State the laws of refract6ion [3 Marks]

b) Differentiate between

   (i) Apparent and real depth [2 Marks]

   (ii) Convex and concave lenses [2 Marks]

c) Calculate the angle of refraction for a ray of light from air striking an air-glass interface making an angle of 60^0 with the interface. (ang = 1.5) [4 Marks]

d) A light ray enters a rectangular block of plastic at an angle $\theta_1 = 45.0°$ and emerges at an angle $\theta_2 = 76.0°$, as shown in the Figure below. (i) Determine the index of refraction of the plastic. (ii) If the light ray enters the plastic at a point L = 50.0 cm from the bottom edge, how long does it take the light ray to travel through the plastic?

[9 Marks]

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