



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF HEALTH AND APPLIED SCIENCES**

**DEPARTMENT OF NATURAL AND APPLIED SCIENCES**

<b>QUALIFICATION :</b> BACHELOR OF ENVIRONMENTAL HEALTH SCIENCES BACHELOR OF HEALTH INFORMATION SYSTEMS MANAGEMENT BACHELOR OF MEDICAL LABORATORY SCIENCES BACHELOR OF HUMAN NUTRITION	
<b>QUALIFICATION CODE:</b> 08BEHS 07BHIS 08BMLS 08BOHN	<b>LEVEL:</b> 5
<b>COURSE:</b> HEALTH SCIENCE PHYSICS	<b>COURSE CODE:</b> HSP511S
<b>SESSION:</b> JUNE 2019	<b>PAPER:</b> THEORY
<b>DURATION:</b> 3 HOURS	<b>MARKS:</b> 100

<b>FIRST OPPORTUNITY EXAMINATION PAPER</b>	
<b>EXAMINER(S)</b>	MR VAINO INDONGO
<b>MODERATOR:</b>	PROF DIPTI R. SAHU

<b>INSTRUCTIONS</b>	
1.	Write all your answers in the answer booklet provided.
2.	Read the whole question before answering.
3.	Begin each question on a new page.

PERMISSIBLE MATERIALS  
1. Scientific Calculator

**THIS QUESTION PAPER CONSISTS OF 4 PAGES  
(INCLUDING THIS FRONT PAGE)**

**QUESTION 1****[20]**

1.1 Derive the dimension of the following:

- 1.1.1 Impulse, (3)  
1.1.2 Surface tension, (3)  
1.1.3 Strain. (3)

1.2 The period of vibration of the liquid surface of a drop depends on the density, radius and surface tension of the liquid. Use dimensional analysis or otherwise to deduce an expression for the dependence of the period of vibration of the liquid drop on these quantities. (11)

**QUESTION 2****[20]**2.1 If  $\vec{A} = i + 2j - 3k$ ,  $\vec{B} = 2i - 3j + 4k$ . Find;

- 2.1.1  $\vec{A} \cdot \vec{B}$ , (3)  
2.1.2 the magnitude of  $\vec{A}$ , (3)  
2.1.3 the magnitude of  $\vec{B}$ , (3)  
2.1.4 the angle between the two vectors  $\vec{A}$  and  $\vec{B}$  (3)

2.2 What is the cross product of vectors,  $\vec{A} = i + 2j - 3k$ ,  $\vec{B} = 2i - 3j - k$ . (4)2.3 The position of a particle is given by  $\vec{r} = 2t\vec{i} + 4t^3\vec{j} + 2t^2\vec{k}$  metre (with time  $t$  in seconds).

Find expressions for

- 2.3.1 its velocity, (2)  
2.3.2 its acceleration as a function of time. (2)

**QUESTION 3****[20]**

3.1 Define instantaneous velocity. (2)

3.2 A train travelling at 20 m/s undergoes a uniform retardation of 2 m/s<sup>2</sup> when brakes are applied. Calculate;

- 3.2.1 the time to come to rest, (3)  
3.2.2 the distance travelled from the place where the brakes were applied. (3)

3.3 A body is projected from the ground at an angle  $\theta$  to the horizontal with a velocity of 30m/s. it reaches a maximum height of 11.25m. Calculate  
3.3.1 the value of  $\theta$ , (3)

3.3.2 the time to strike the ground. (3)

3.4 An arrow of mass 0.3 kg is fired with a velocity of 100 m/s into a wooden block of mass 0.7 kg. Calculate the final kinetic energy after impact, given that the wooden block can freely move. (6)

**QUESTION 4** [20]

4.1 An object of weight 150 N moves with a speed of 4.5 m/s in a circular path of radius 3m. Calculate its centripetal acceleration and the magnitude of the centripetal force [Take  $g = 10 \text{ m/s}^2$ ] (5)

4.2 A stone of mass 500 g tied to a rope 50 cm long is whirled at an angular velocity of 12.0 rad/sec. Calculate the centripetal force. (3)

4.3 A force is required to keep a 5 kg mass moving round a cycle of radius 3.5 km at a speed of 7 m/s. What is the speed, if the force is doubled? (3)

4.4 A body of mass 20 g is suspended from the end of a spiral spring whose force constant is 0.4 N/m. The body is set into a simple harmonic motion with amplitude 0.2 m. Calculate

4.4.1 the period of the motion, (3)

4.4.2 the frequency of the motion, (3)

4.4.3 the total energy, (3)

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**QUESTION 5** [20]

5.1 Distinguish between a lamina flow and a turbulent flow. (4)

5.2 A reservoir is filled with a liquid of density  $2000 \text{ kgm}^{-3}$ . Calculate the depth at which the pressure in the liquid will be equal to  $9100 \text{ Nm}^{-2}$  [Take  $g = 10 \text{ m/s}^2$ ]. (3)

5.3 A rectangular block of wood floats in water with two-third of its volume immersed. When placed in another liquid, it floats with half of its volume immersed. Calculate the relative density of the liquid. (4)

5.4 Normal human body temperature is  $34^{\circ}\text{C}$ , what is the equivalent value in

5.4.1 Fahrenheit,

(3)

5.4.2 Kelvin.

(3)

5.5 An iron plate  $2 \times 10^{-2}$  m thick has a cross-sectional area of  $5000 \text{ cm}^2$ . One side is at  $180^{\circ}\text{C}$  and the other side at  $160^{\circ}\text{C}$ . How much heat is transmitted per second? The thermal conductivity of iron is  $76 \text{ Wm}^{-1} \text{ K}^{-1}$ .

(3)

END