الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا
كلية عمان البحرية الدولية
International Maritime College Oman

Final Exam
MPHYS - I: PHYSICS - 1
Fall 2024

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration: 2 hours
Instructor's Name: RANJIT V
Exam Date: 8/1/2025
Program: ME

	40
	10

Student Information

Name: _____ ID: _____

Signature: _____

Invigilator

Initials: _____ ☐ Student ID checked

Time received: _____

Question 1 **[8 marks]**

MCQ & Very short answer questions – Each question carries one mark.

a) Newton's First law of motion is also called .....

i) Law of momentum
ii) Law of inertia
iii) Law of normal reaction
iv) Law of gravitation

b) Which type of friction is the smallest?

i) Static friction
ii) Sliding friction
iii) Rolling friction
iv) Normal friction

c) If a spring is stretched beyond its elastic limit, how will it behave?

i) It will obey Hooke's Law indefinitely.
ii) It will undergo plastic deformation and not return to its original shape.
iii) It will oscillate between the stretched and compressed positions.
iv) It will become more resistant to deformation.

d) In Fleming's Left-Hand Rule, what does the thumb represent?

i) Direction of magnetic field
ii) Direction of force
iii) Direction of current
iv) Direction of motion

e) Work is defined as the dot product of force and displacement.
What happens to the work done if the angle between the force and displacement is 90°?

i) Work is maximum
ii) Work is zero
iii) Work is negative
iv) Work is positive but not maximum

f) Which of the following is TRUE about transformers?

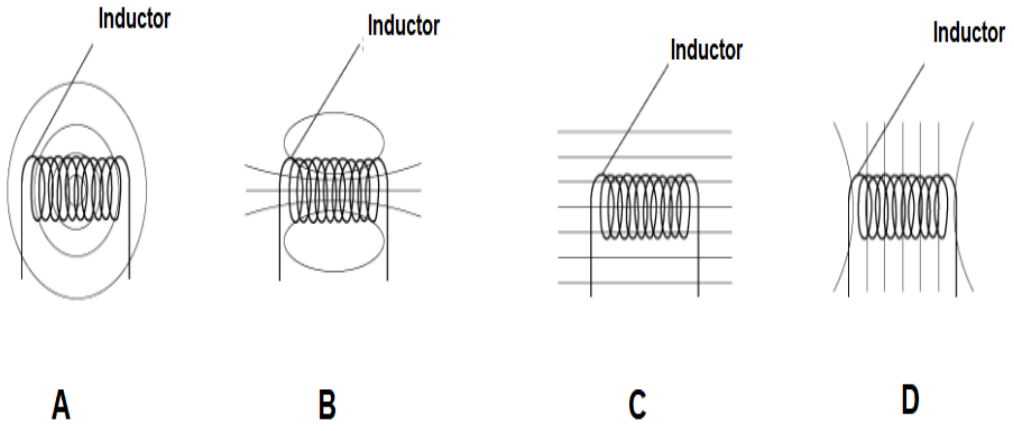
i) They work on DC voltage.

ii) They transfer voltages/current between two circuits by electromagnetic induction.

iii) The efficiency of transformers is always 100%.

iv) The primary and secondary coils are connected to each other.

g) Which diagram shows the correct magnetic field lines around a current-carrying inductor?



(Shaalaa.com, 2019)

h) The SI unit of electromotive force(e.m.f) is

i) Joule ii) Ampere

iii) Volt iv) Watt

Question 2 **[9 marks]**

a) Differentiate between Work done and Power. Write two points each. (2 marks)

b) A fishing boat of mass 5000 kg starts from rest and gains an average speed of 30 knots in 3 minutes.

i) Determine the work done by the boat's engine for 3 minutes. (5 marks)

(Given 1 knot = 1.852 km/h)

ii) Calculate the power consumed by the fishing boat in 3 min.

(3 marks)

Question 3 **[8 marks]**

A water storage can is filled with water. The total mass of the can with water is 80 kg.

a) Calculate the total weight of the tank. (2 marks)

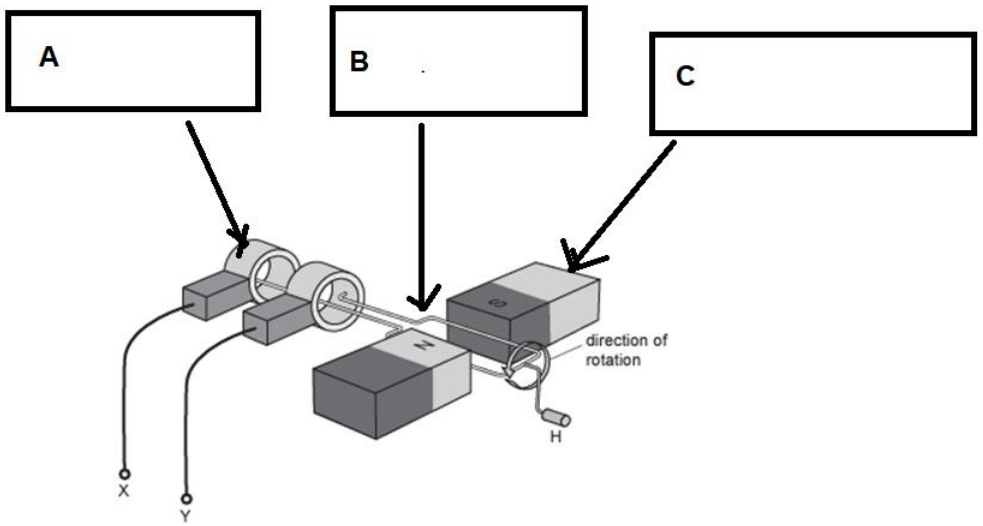
b) The tank is hung with a spring. The initial length of the spring is 40 cm. After loading the tank, the length of the spring increased to 88 cm. By using Hooke's law, determine the spring constant. (2 marks)

c) Once the water is drained, the empty tank is hung with the same spring, which stretches to 48 cm. Calculate the force that stretches the spring to this length. (2 marks)

d) Using the answers in part (a) and part (c), calculate the total mass of water drained from the tank. (2 marks)

Question 4 **[9 marks]**

The figure below represents an alternating current (a.c) generator.



(Unacademy, n.d.)

a) Label the parts A. B and C in the above figure. (1.5 marks)

b) A student rotates the handle H.

Draw a graph to show how the electromotive force (e.m.f) between the X and Y terminals varies with time during two complete revolutions of the coil. (1.5 marks)

c) State how the emf will change if the student turns the handle quickly to make more revolutions. (1 mark)

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d) If the terminals X and Y are connected to the primary coil of a transformer. Describe the working principle of a transformer. (You can draw the diagram of a transformer to support your answer) (2 marks)

e) An ideal step-down transformer is connected to a 240V main supply. A 12V, 30W laptop adaptor is desired to operate using it.

i) Calculate the transformer ratio. (1 marks)

ii) Calculate the current in the primary and secondary coil of the transformer. (2 marks)

Question 5 **[6 marks]**

a) Explain newtons 2nd law and 3rd law using some examples. (2 marks)

b) Discuss the various factors on which the frictional force depends. Name any two frictional forces when a ship is moving through the sea. (4 marks)

CONVERSION OF PHYSICAL QUANTITIES

Conversion of Length		Conversion of Mass		Conversion of Time	
1km	10^{3} m	1 Kg	10^{3} g	1 year	365 days
1m	10^{-3} km	1 g	10^{-3} Kg	1 month	30 days
1m	10^{2} cm			1 day	24 hours
1cm	10^{-2} m	1 g	10^{3} mg	1 hour	60 minutes
1m	10^{3} mm	1 mg	10^{-3} g	1 minute	60 seconds
1 mm	10^{-3} m				
1m	10^{6} μm	1 Kg	10^{6} mg	1 second	10^{3} ms
1 μm	10^{-6} m	1 mg	10^{-6} Kg	1 ms	10^{-3} seconds
1m	10^{9} nm				
1 nm	10^{-9} m	1 g	10^{6} μg	1 second	10^{6} μs
1m	10^{12} pm	1 μg	10^{-6} g	1 μs	10^{-6} seconds
1 pm	10^{-12}m				
1 mile	1.60934 Km	1 Kg	10^{9} μg	1 second	10^{9} ns
1 Km	0.621371 miles	1 μg	10^{-9} Kg	1 ns	10^{-9} seconds
1 nautical mile	1.15078 miles				
1 mile	0.868976 nautical miles	1 Tone	10^{3} Kg	1 second	10^{12} ps
1 nautical mile	1.852 Km	1 Kg	10^{-3} Tone	1 ps	10^{-12} seconds
1 Km	0.5399 nautical mile				

CONVERSION OF SPEED/VELOCITY

1mph (miles per hour) = 1.60934 km/h (kilo meter per hour)

1Km/h (kilo meter per hour) = 0.621371mph (miles per hour)

1Knot = 1.15078 mph (miles per hour)

1 mph (miles per hour) = 0.868976 Knot

1 Knot = 1.852 Km/h

1 Km/h = 0.539957 Knot

1 Km/h = 0.277778 m/s

1 m/s = 3.6 Km/h

MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	**1,2,3**	Recall, Knowldege,	**8**	All question need to be done
2	**2**	Apply	**9**	
3	**2,3**	Apply and Analysis	**8**	
4	**2,3,4**	Apply, Analysis and evalate	**9**	
5	**3, 1**	Knowledge and Analysis	**6**	

Reference

Shaalaa.com (2019). *Shaalaa*. [online] Shaalaa.com. Available at: https://www.shaalaa.com/question-bank-solutions/draw-pattern-magnetic-field-lines-solenoid-through-which-steady-current-flows-what-does-pattern-field-lines-inside-solenoid-indicate_49550 [Accessed 14 Dec. 2024].

Unacademy. (n.d.). *AC and DC Generator*. [online] Available at: https://unacademy.com/content/jee/study-material/physics/ac-and-dc-generator/.