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

ACADEMIC YEAR 2023 - 2024

Program	Year	Semester	Paper
DO	1	2	MAIN

MODULE NAME:	**PHYSICS – II**		
MODULE CODE:	**DPHYS – II**	**EXAM DATE:**	**27/05/2024**
INSTRUCTOR's NAME:	**Jahanzeb Khan Bahadur**	**DURATION:**	**2 hrs**

Questions to be answered on:	**Allowed tools:**	**Number of pages**
✓ Space provided on the question paper	Pen, Pencil & Calculator	(Incl. cover page)**: 09**

Points of attention:

- For each question, the maximum earned points are mentioned between brackets at the end of each question.
- Write very clearly! Answers that are not readable are not marked and don't get points!
- Make sure your answers are written to the point.
- All answers should be written **in English.**
- Write all the answers in **blue or black pen only.**
- Use the **pencil** only for **diagrams & 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.

STUDENT NAME:

STUDENT ID:

FINAL MARKS

	40
	10

Number of answer scripts:……..…….

Invigilator:……..……..…..

Student's signature: ……

Time of receipt:……..…..

Question 1 **[Total Marks: 08]**

The total length of the beam is 120 cm and it is pivoted at the center of mass. A load of 46 N is hanged at 33 cm from the left end of the beam and Newton meter (spring balance) is 36 cm away from the pivot (axis of rotation) on the other side of pivot.

a) Draw a labelled diagram of the above situation for the class – 1 type of lever. (2 marks)

b) Calculate the force required to keep the beam horizontally balanced. (2 marks)

c) Now replace the class I type with class 3 lever and redraw the figure for the situation given in the question above. (2 marks)

(d) Calculate the force required to keep the beam horizontally balanced n this case now.

(2 marks)

Question 2 **[Total Marks: 06]**

(a) The centripetal force required to keep an onject in a circular orbit of radius "r" is given by $F_c = \frac{mv^2}{r}$. Discuss the effect on centripetal force by showing the mathematical working if the velocity is increased by 3 times. (2 mark)

(b) The total mass of a propeller is 2.2 tonne and the diameter of the propeller is 80 cm and the average rotational speed of the propeller is 15 km/h.

(i) Calculate the centripetal force required to keep the propeller in rotation. (2 marks)

(ii) Calculate the centripetal acceleration due to centripetal force. (2 marks)

Question 3 **[Total Marks: 07]**

(a) Discuss the advantages of using microwaves for sending and receiving signals to geostationary satellites. Give the range of microwaves frequencies used for sending signals to geostationary satellites. (2 marks)

(b) An artificial satellite is launched at a height of 36,000 km above the surface of the Earth. Calculate the orbital velocity for this satellite to hold in the orbit of the Earth in m/s. (3 marks)

(c) Calculate the time required to complete one revolution around the Earth by this satellite and discuss the relation between orbital velocity and time period of the satellite. (2 marks)

Question 4 **[Total Marks: 06]**

A submarine descends into the sea to a depth of 120 m below the surface of water. The density of the sea water is 1.03 g/cm^3. Atmospheric pressure is 1.0 x10^5 Pa.

(a) Calculate the absolute pressure as it descends from the surface to a depth of 120 m.

(2 marks)

(b) On another dive, the submarine experiences a total pressure of 6.5 x10^5 Pa. A hatch cover on the submarine has an area of 2.5 m^2. Calculate the force on the hatch cover of the submarine.

(2 marks)

(c) The submarine undergoes tests in fresh water of density 1.0 g/cm^3. Explain why the pressure on the submarine is less at the same depth. (2 marks)

Question 5 **[Total Marks: 08]**

(a) Draw the image formation by a single convex lens when object is placed at 2F where "F" is the focal length of the lens.Write any two properties of the image. (3 marks)

(b) Differentiate between mechanical waves and electromagnetic waves with the help of examples. (2 marks)

(c) Waves entering from a region of shallow water into deep water region. These waves having a speed of 0.35 m/s with wavelength 0.15 m in the shallow water. If the wavelength of the wave in deep water is 0.21 m, calculate the speed of the wave in deep water.(3 marks)

Question 6 **[Total Marks: 05]**

(a) Classify the sound into infrasonic, ultrasonic and audiable sound according to their frequencies. (3 marks)

(b) FM radio is transmitted at 103 MHz Calculate the wavelength of FM transmission. (2 marks)

USEFUL INFORMATION

Universal Gravitational Constant G = 6.67 x 10^{-11} N m^2 kg^{-2}

Mass of the Earth = 6.0 x 10^{24} kg — Radius of the Earth = 6.4 x 10^6 m

Mass of the Sun = 2.0 x 10^{30} kg — Radius of the Sun = 6.96 x 10^8 m

Mass of the Moon = 7.36 x 10^{22} kg — Radius of the Moon = 1.64 x 10^6 m

Average distance from Earth to Moon = 3.8 x 10^8 m

Average distance from the Earth to the Sun = 1.5 x 10^{11} m

Average distance from the Moon to the Sun = 1.5 x 10^{11} m

Speed of light, laser light, electromagnetic waves in air = 3 x 10^8 m/s

USEFUL FORMULAS

$\tau = F \times d \times \sin\theta$

Centripetal force $F_c = \frac{mv^2}{r}$

Law of gravitation $F = G\frac{m_1 \times m_2}{r^2}$

Orbital velocity for satellite $v = \sqrt{\frac{Gm_e}{r}}$

Time period for satellite $T = \frac{2\pi r}{v}$

Wave velocity / Relation between wavelength, frequency, and velocity $v = f \times \lambda$

Pressure on a surface area P = F/A

Pressure due to liquid = $\rho \times g \times h$

Refractive index $(\eta) = \frac{Sin\angle i}{Sin\angle r}$ (for rare to denser)

Refractive index $(\eta) = \frac{Sin\angle r}{Sin\angle i}$ (for denser to rare)

Refractive index $(n) = \frac{Speed\ of\ light\ in\ air}{Speed\ of\ light\ in\ medium}$ (with respect of speed of light)