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FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2025

(CUFYUGP)

PHY1MN101/APH1MN101: Mechanics and Optics

2024 Admission onwards

Maximum Time :2 Hours | **Maximum Marks :70**

Section A

All Questions can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

1	Write down the expression for terminal speed of an object falling through a fluid. Why a sheet of paper falls faster if you first crumple it into a ball?
2	Discuss the concept of apparent weight and actual weight in the context of a person standing in an elevator which is accelerating up and down
3	"In general, the normal force is not equal to the weight." Give an example in which these two forces are equal in magnitude, and at least two examples in which they are not.
4	How work done by a varying force is calculated for straight line motion? How will you find out it from force-position graph?
5	Show that it is easier to pull a body along a rough surface than push it.
6	Distinguish between Fresnel diffraction and Fraunhofer diffraction
7	White light entering diamond emerges as multi colored spectrum. Explain this phenomenon
8	If a spherical glass lens is immersed in water, does its focal length change? Explain
9	Write a short note about f-number of a lens
10	Using Snell's law explain critical angle and total internal reflection

Section B

All Questions can be answered. Each Question carries 6 marks (Ceiling : 36 Marks)

11	A 6.00-kg box sits on a ramp that is inclined at 37.0° above the horizontal. The coefficient of kinetic friction between the box and the ramp is 0.30. What horizontal force is required to move the box up the incline with a constant acceleration of 3.60 m/s^2?
12	You tie a cord to a pail of water (mass= 5kg) and swing the pail in a vertical circle of radius 0.600 m. (a) What minimum speed must you give the pail at the highest point of the circle to avoid spilling water? (b) What is the minimum speed required at the lowest point to complete the entire vertical circle. (c) Tension at highest and lowest point
13	Define conservative force. Prove that the work done by all forces other than the conservative forces equals the change in the total mechanical energy of the system

14	A farmer hitches her tractor to a sled loaded with firewood and pulls it a distance of 20 m along level ground. The total weight of sled and load is 14,700 N. The tractor exerts a constant 5000-N force at an angle of 36.9° above the horizontal. A 3500-N friction force opposes the sled's motion. Find the total work done by all the forces
15	A beam of light has a wavelength of 650 nm in vacuum. (a) What is the speed of this light in a liquid whose index of refraction at this wavelength is 1.47? (b) What is the wavelength of these waves in the liquid? (c) what is frequency of these waves in liquid
16	Derive object-image relationship for spherical refracting surface. Also obtain the equation for lateral magnification.
17	A concave mirror forms an image, on a wall 3.00 m in front of the mirror, of a headlamp filament 10.0 cm in front of the mirror. (a) What is the radius of curvature and focal length of the mirror? (b) What is the lateral magnification? What is the image height if the object height is 5.00 mm?
18	Briefly explain the physics behind formation of primary and secondary rainbow
Section C	
Answer any ONE .Each Question carries 10 marks (1x10=10 Marks)	
19	a) State and obtain work-energy theorem b) State and obtain law of conservation of mechanical energy for a particle experiencing gravitational force alone. c) Using the relationship between force and potential energy, obtain the expression for elastic force. Graphically represent elastic potential energy and force as functions of displacement x. Find out the equilibrium point.
20	What you meant by interference of light? Discuss interference from two identical slit. Analyses the intensity variation on the screen.