

QP Code: D132358		Total Pages: 2	Name:
		Register No.	
<b>FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2025</b>			
(CUFYUGP)			
<b>PHY1CJ101/APH1CJ101/APH1MN100/PHY1MN100: Fundamentals of Physics</b>			
<b>2024 Admission onwards</b>			
<b>Maximum Time :2 Hours</b>		<b>Maximum Marks :70</b>	
<b>Section A</b>			
<b>All Questions can be answered. Each Question carries 3 marks (Ceiling: 24 Marks)</b>			
1	Distinguish between mass and weight. How they can be measured?		
2	One coin was dropped from rest from the Leaning Tower of Pisa. If the coin falls freely, so that the effects of the air are negligible, how does the net force on the coin vary as it falls?		
3	State Newton's first and second laws.		
4	What factors cause the variation of acceleration due to gravity ( $g$ ) on Earth?		
5	If there is a net force on a particle undergoing uniform circular motion, why doesn't the particle's speed change?		
6	Define terminal speed of a body. Heavy objects in air tend to fall faster than light objects. Justify.		
7	State the principle of conservation of energy. Provide an example to illustrate the principle.		
8	Distinguish between average power and instantaneous power. What is the commercial unit of electricity consumption? Give the SI unit conversion of it.		
9	Differentiate between conservative and non-conservative forces with examples.		
10	Explain the concepts of stable and unstable equilibrium in energy diagrams.		
<b>Section B</b>			
<b>All Questions can be answered. Each Question carries 6 marks (Ceiling: 36 Marks)</b>			
11	A stonemason drags a marble block across a floor by pulling on a rope attached to the block. The block is not necessarily in equilibrium. How are the various forces related? What are the action-reaction pairs?		
12	Consider two balls dropped from a height of 50 meters. Calculate their velocity just before hitting the ground, assuming no air resistance. Masses of the balls are 1 kg and 5 kg, respectively. Use the value of gravitational acceleration as $10 \text{ m/s}^2$ .		
13	Two dogs pull horizontally on ropes attached to a post; the angle between the ropes is $60.0^\circ$ . If Rover exerts a force of 270 N and Fido exerts a force of 300 N, find the magnitude of the resultant force and the angle it makes with Rover's rope.		

14	A student weighing 550 N stands on a weighing machine in an elevator that is supported by a cable. As the elevator starts moving, the machine reads 450 N. (i) Find the magnitude and direction of the acceleration of the elevator. (ii) What is the acceleration if the weighing machine reads 670 N? (iii) If the machine reads zero, should the student worry? Explain.
15	State and explain the work-energy theorem. Using the theorem, derive the expression for the kinetic energy of a particle of mass $m$ moving with velocity $v$ .
16	Two ice boats have mass 'm' and '2m'. The ice boats have identical sails, so the wind exerts same constant force on each boat. They start from rest and cross the finish line a distance 's' away. Which ice boat crosses the finish line with greater kinetic energy? Justify your answer.
17	Each of the four jet engines on an Airbus A380 airliner develops a thrust (a forward force on the airliner) of 322,000 N. When the airplane is flying at 250 m/s what horse power does each engine develop?
18	A spring with a spring constant of 200 N/m is compressed by 0.1 m from its natural length. Calculate the work done on the spring during this compression. Additionally, if the spring is released, what will be the speed of a 2 kg mass attached to the spring as it passes the equilibrium position?
<b>Section C</b>	
<b>Answer any ONE. Each Question carries 10 marks (1x10=10 Marks)</b>	
19	Explain the concept of work done by a variable force. Discuss how the work done can be calculated for a force that varies with displacement, and provide an example of its practical application, such as stretching a spring or pulling an object.
20	Compare the motion of a car on a flat curve and on a banked curve, highlighting the role of friction in each case.

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(Pages : 3)

Name.....

Reg. No.....

**FIRST SEMESTER (CUFYUGP) DEGREE EXAMINATION  
NOVEMBER 2024**

Applied Physics/Physics

APH1CJ101/PHY1CJ101—FUNDAMENTALS OF PHYSICS

(2024 Admission onwards)

Time : Two Hours

Maximum : 70 Marks

**Section A***Answer all questions.**Each question carries 3 marks.**(Ceiling : 24 marks).*

1. Distinguish between inertial and non-inertial frames of reference. Is earth an inertial frame ? Explain.
2. What is meant by apparent weight of a body ? Why does an astronaut in a space station orbiting earth feel weightlessness ?
3. State work-energy theorem. A satellite moving in a stable circular orbit around earth maintains a constant speed. What is the work done by the force of gravity on the satellite ?
4. Distinguish between mass and weight of a body. How can they be measured ?
5. What is the difference between kinetic and static friction ? Why force of friction increases when the two surfaces in contact are made extremely smooth ?
6. Distinguish between conservative forces and non conservative forces with suitable examples.
7. State Newton's third law of motion. A boy tries to lift himself by pulling on the laces of his own shoes. Will he succeed ? Justify your answer.
8. Which feels a greater pull due to the earth's gravity : a 10 kg. stone or a 20 kg. stone ? If you drop the two stones, why doesn't the 20-kg stone fall with twice the acceleration of the 10 kg. stone ? Explain.

**Turn over**

9. Define Power and give its SI unit. How is power related to the instantaneous velocity of a body ?
10. Discuss the fundamental forces in nature and arrange them in the ascending order of their strengths.

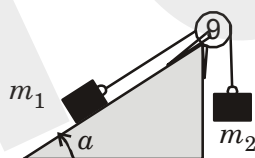
### Section B

*Answer all questions.*

*Each question carries 6 marks.*

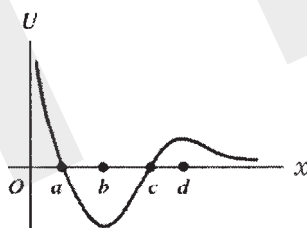
*(Ceiling : 36 marks)*

11. A crate with mass 32.5 kg. initially at rest on a warehouse floor is acted on by a net horizontal force of 14.0 N. (a) What is the acceleration produced ? ; (b) How far does the crate travel in 10.0 s ? ; (c) What is its speed at the end of 10.0 s ?
12. Define terminal speed of a body. Discuss how fluid resistance force varies for : (i) Small objects moving at very low speeds ; and (ii) For large objects moving at high speeds. Obtain expressions for terminal speeds in the two cases.
13. Two masses  $m_1$  and  $m_2$  are connected by a rope of negligible mass passing over a smooth frictionless pulley as shown in figure ; (a) Draw the free-body diagrams for  $m_1$  and  $m_2$  ; (b) Find the magnitude of the acceleration of the masses ; (c) What is the tension in the rope while the masses are moving ? Neglect friction between the mass  $m_1$  and the inclined surface.



14. A 25.0 kg. child plays on a swing having support ropes that are 2.20 m. long. Her brother pulls her back until the ropes are  $42.0^\circ$  from the vertical and releases her from rest ; (a) What is her potential energy just as she is released, compared with the potential energy at the bottom of the swing's motion ? ; (b) How fast will she be moving at the bottom ? ; and (c) How much work does the tension in the ropes do as she swings from the initial position to the bottom of the motion ?
15. A 4.80 kg. watermelon is dropped from rest from the roof of an 18.0 m. tall building and feels no appreciable air resistance : (a) Calculate the work done by gravity on the watermelon during its displacement from the roof to the ground ; (b) Just before it strikes the ground, what is the watermelon's ; (i) Kinetic energy ; and (ii) Speed ?

16. A marble moves along the  $x$ -axis. The potential-energy function is shown in figure below. At which of the labeled  $x$ -co-ordinates is the force on the marble zero ? ; (b) Which of the labeled  $x$ -co-ordinates is a position of stable equilibrium ? ; (c) Which of the labeled  $x$ -co-ordinates is a position of unstable equilibrium ?



17. An elevator of total mass 1800 kg. is moving up with a constant speed of 2 m/s. A frictional force of 4000 N opposes its motion. Determine the minimum power to be delivered by the motor to the elevator.
18. To simulate car accidents, auto manufacturers study the collisions of moving cars with mounted springs of different spring constants. Consider a typical simulation with a car of mass 1000 kg. moving with a speed of 18 km/h. on a smooth road and colliding with a horizontally loaded spring of spring constant  $6.25 \times 10^3$  N/m. What is the maximum compression of the spring ?

### Section C

*Answer any **one** questions.*

*Each question carries 10 marks.*

19. (i) Discuss the dynamics of a body undergoing uniform circular motion in a horizontal circle and hence bring about the difference between centripetal force and centrifugal force ; and (ii) Explain how banking of curved roads ensures safety of vehicles and reduce wear and tear of the tires.
20. (i) Compare and contrast the concepts of gravitational potential energy of a system and elastic potential energy of a spring-mass system ; (ii) Using suitable energy diagram, discuss the relationship between potential energy and stability of a system ; and (iii) Show graphically the variation of gravitational potential energy and gravitational force with vertical displacement of a body.

(1 × 10 = 10 marks)