

24U114

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Name : .....

Reg. No : .....

**FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2024**

(FYUGP)

**CC24U PHY1 CJ101 - FUNDAMENTALS OF PHYSICS**

(B.Sc. Physics - Major Course)

(2024 Admission - Regular)

Time: 2.0 Hours

Maximum: 70 Marks

Credit: 4

**Part A** (Short answer questions)

Answer *all* questions. Each question carries 3 marks.

1. Interpret the meaning of “net force” in the context of Newton’s First Law. [Level:2] [CO1]
2. Describe the steps involved in constructing a free-body diagram for a static object. [Level:2] [CO1]
3. Define static friction and explain how it differs from kinetic friction. [Level:1] [CO2]
4. Explain how the fundamental forces influence the interactions between different particles. [Level:2] [CO2]
5. Interpret the work-energy theorem in terms of energy conservation. [Level:2] [CO3]
6. Identify the SI unit of work. [Level:1] [CO3]
7. Apply the concept of energy conservation to a spring system in motion. Discuss how elastic potential energy transforms into kinetic energy as the spring returns to its equilibrium position. [Level:3] [CO4]
8. Explain how gravitational potential energy affects the potential height an object can reach when launched vertically. [Level:2] [CO4]
9. Describe how energy diagrams reflect the potential and kinetic energy during the pendulum’s swing. [Level:2] [CO4]
10. Explain how potential energy changes as an object falls and how it relates to the forces acting on it. [Level:2] [CO4]

**(Ceiling: 24 Marks)**

**Part B** (Paragraph questions/Problem)

Answer *all* questions. Each question carries 6 marks.

11. A 20 kg box is being pulled across a horizontal surface by a force of 100 N at an angle of  $30^\circ$  above the horizontal. Calculate the acceleration of the box. [Level:3] [CO1]

12. A force of 50N acts at  $45^\circ$  to the horizontal, while another force of 80N acts vertically. Find the resultant force, and determine the direction of the resultant force relative to the horizontal. [Level:2] [CO1]
13. A 2 kg object is taken to a planet where the gravitational acceleration is half of that on Earth. Calculate its weight on Earth and on this new planet. [Level:3] [CO1]
14. Calculate the tension in a rope pulling a 20 kg sled up a frictionless incline at an angle of  $30^\circ$  with an acceleration of  $2 \text{ m/s}^2$ . [Level:3] [CO2]
15. A parachutist with mass  $m = 70 \text{ kg}$  is descending at terminal velocity. Given that  $D = 0.22 \text{ kg/m}$ , find the terminal velocity. [Level:3] [CO2]
16. In a lift accelerating downward at  $4 \text{ m/s}^2$ , determine the apparent weight of a 55 kg passenger. [Level:3] [CO2]
17. A construction worker lifts a beam weighing 150 N to a height of 4 m in 2 seconds. Calculate the power exerted while lifting the beam. [Level:3] [CO3]
18. A 50 N force is applied to a cart, moving it 10 m on a frictionless surface. Using the area under the force vs displacement graph, calculate the total work done on the cart. [Level:3] [CO3]

**(Ceiling: 36 Marks)**

**Part C (Essay questions)**

Answer any *one* question. The question carries 10 marks.

19. Use vector addition principles to demonstrate how multiple forces acting on a particle lead to equilibrium. Provide a explanation of vector resolution into components and the conditions for equilibrium. Include an example where three or more forces act at different angles on a particle, and show the calculations for determining unknown forces. [Level:3] [CO2]
20. Apply the concept of potential energy and force to explain the movement of particles in a one-dimensional potential energy landscape. Discuss how particles tend to move toward regions of lower potential energy and how the direction and magnitude of force guide this motion. [Level:3] [CO4]

**(1 × 10 = 10 Marks)**

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