

D 93942-B

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Name.....

Reg. No.....

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION, NOVEMBER 2020

Physics/Applied Physics

PHY 1B 01/APH 1B 01—MECHANICS-I

(2020 Admissions)

Time : Two Hours

Maximum : 60 Marks

The symbols used in the question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** questions.

Each question carries 3 marks.

All questions can be attended.

Overall Ceiling 24.

1. With proper examples define contact forces.
2. What are the fundamental forces in nature ? Compare their strengths.
3. Explain the gravitational force of a sphere.
4. Explain central force. Show that the work done by a central force is path independent.
5. State the law of conservation of linear momentum with one example.
6. Define moment of inertia. How is it related to angular momentum ?
7. State and explain the work energy theorem.
8. Show that angular momentum is conserved for a particle in central force motion.
9. Define power with its various units.
10. Obtain the expression for change in acceleration due to gravity with height.
11. Draw the energy diagram for a harmonic oscillator and explain.
12. State and explain parallel axis theorem.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph / Problem Type)

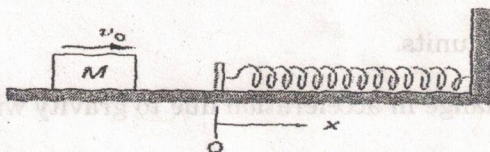
Answer at least five questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. A 5kg mass moves under the influence of a force $F = (4t^2\hat{i} - 3t\hat{j})\text{N}$, where t is the time in seconds, ($1\text{N} = 1\text{Newton}$). It starts at rest from the origin at $t = 0$. Find
- Its velocity,
 - Its position, and
 - $\mathbf{r} \times \mathbf{v}$, for any later time.
14. Mass m is whirled on the end of a string length R . The motion is in a vertical plane in the gravitational field of the earth. The forces on m are the weight W down, and the string force T towards the centre. The instantaneous speed is v , and the string makes angle θ with the horizontal. Find the T and the tangential acceleration at this instant.
15. A uniform rope of mass m and length l is attached to a block of mass M , The rope is pulled with force F . Find the tension at distance x from the end of the rope. Neglect gravity.
16. A block of mass M slides along a horizontal table with speed v_0 . At $x = 0$, it hits a spring with spring constant k and begins to experience a friction force, as indicated in the sketch. The co-efficient of friction is variable and is given by $\mu = bx$, where b is a constant. Find the distance l the block travels before coming to rest.



17. Show that :

- If the total linear momentum of a system of particles is zero, the angular momentum of the system is the same around all origins.
- Show that if the total force on a system of particles is zero, the torque on the system is the same around all origins.