I Semester B.Sc. Examination, March/April 2022
(CBCS) (Repeaters) (2016-17 and Onwards)
PHYSICS – I
Mechanics – I, Heat and Thermodynamics – I

Time : 3 Hours   Max. Marks : 70

Instructions : 1) Answer **any five** questions from **each** Part.
2) **Use** of non-programmable scientific calculator are allowed.

PART – A

Answer **any five** questions. **Each** question carries **eight** marks.   **(5×8=40)**

1. a) Derive an expression for the displacement of a particle in a resistive
        medium. Draw displacement time graph.

    b) Define time constant.   **(7+1)**

2. Obtain an expression for acceleration and velocity of a body moving along an
    inclined plane without friction.   8

3. a) State and prove work-energy theorem.

    b) Distinguish between conservative and non-conservative forces with
        examples.   **(4+4)**

4. a) Write any two properties of thermal radiation.

    b) Assuming Planck's radiation law, deduce Wien's distribution law and
        Rayleigh-Jeans law for blackbody radiation.   **(2+6)**

5. Obtain an expression for the pressure exerted by a gas based on kinetic
    theory.   8

6. Derive the relation for the co-efficient of viscosity of a gas on the basis of
    kinetic theory of gases.   8

7. a) What is a cyclic process ?

    b) Show that PV^γ = constant for an adiabatic process.   **(1+7)**

8. a) What is entropy ?

    b) Derive an expression for change in entropy in an reversible process.   **(2+6)**

PART – B

Answer **any five** of the following problems. **Each** problem carries **four** marks. (5×4=20)

9. A block slides on ice with a velocity of 5 ms⁻¹ and comes to rest after moving through a distance of 13.5 m. Find the co-efficient of friction.

10. Determine the escape velocity of a body from the moon. Take the moon to be a uniform sphere of radius 1.74×10^6 m, mass to be 7.36×10^{19} kg and $G = 6.67 \times 10^{-11}$ Nm²kg⁻².

11. A 5 kg body and 8 kg body are moving along the x-axis. At a particular instant the 5 kg body has a velocity of 3 ms⁻¹ and 8 kg body has a velocity of – 1ms⁻¹. Find the velocity of the centre of mass.

12. A uniformly heated enclosure is maintained at 2727°C and has a cavity of diameter 4 mm. Assuming that the cavity behaves like a perfectly blackbody, calculate the energy radiated in 2 minutes from the cavity.

13. Calculate the molecular mean free path of nitrogen molecule, given rms velocity of a molecule of nitrogen is 4.56×10^2 ms⁻¹, density at NTP is 1.26 kgm⁻³ and co-efficient of viscosity being 1.65×10^{-5} NSm⁻².

14. Calculate the Vander Waal's constants for dry air, given that $T_c = 132$ K, $P_c = 38.5 \times 10^5$ Nm⁻² and R = 8.314 J kg⁻¹ deg mole⁻¹.

15. The efficiency of an engine is found to increase from 0.3 to 0.4 when the temperature of sink is lowered by 50°C. Calculate the temperature of source and sink.

16. Calculate the increase in entropy when 1 kg of ice at 273 K is converted into water at 300 K. Specific heat of ice is 4200 Jkg⁻¹K⁻¹, latent heat of ice is 335×10^3 J kg⁻¹.

PART – C

17. Answer **any five** of the following. **Each** question carries **two** marks.   (5×2=10)

   a) "Is it easier to make a body roll over a surface than to slide" ? Explain.

   b) Is there any workdone in moving an object from one point to another on spherical shell ? Justify.

   c) A light body and a heavy body have the same kinetic energy. Which one will have greater momentum ?

   d) Can a body have (a) energy without momentum (b) momentum without energy.

   e) Are thermal radiations electromagnetic in nature ? Explain.

   f) Can an ideal gas be converted into solid or liquid states ? Explain.

   g) If the door of a refrigerator is kept open in a room, will it make the room warm or cool ? Explain.

   h) A reversible adiabatic change is isentropic. Justify.

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