0110244

Reg. No. ☐☐☐☐☐☐☐

I Semester B.Sc. Degree Examination, August - 2021
PHYSICS
Mechanics -1, Heat and Thermodynamics -1
(CBCS-Semester Scheme 2018-2019 Onwards Repeaters)
Paper : I

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates :
1) Answer **any Five** questions from each part.
2) Use of non- programmable scientific calculator is allowed.

PART-A

Answer any FIVE questions. Each question carries 8 marks: (5×8=40)

1. a) State Newton's third law of motion and give an example.   (2+6)
   b) Derive an expression for the instantaneous velocity of a body falling freely under gravity where resistance varies directly as the velocity of the body. Represent the variation of velocity with time graphically.

2. a) Define gravitational field and gravitational potential energy.
   b) Define escape velocity. Derive an expression for the escape velocity of a body from the surface of a planet.   (2+6)

3. a) Distinguish between conservative and non- conservative forces.
   b) Derive an expression for the velocity of a rocket without considering the acceleration due to gravity.   (4+4)

4. Derive Planck's law of radiation.

                                                                                (8)

5. a) Give the mathematical expression for Maxwell's law of distribution of molecular velocities.
                                                                                (2+6)
   b) Using a suitable graph, explain the Maxwell's law of distribution of molecular velocities in a gas at different temperature.

                                                                          [P.T.O.

6. a) Derive the expression for the thermal conductivity of a gas on the basis kinetic theory of gases. **(6+2)**

   b) Discuss the effect of pressure on the thermal conductivity of a gas.

7. a) State and explain First Law of Thermodynamics. **(2+6)**

   b) Define an isothermal process. Obtain an expression for work done by an ideal gas in an isothermal process.

8. Explain the Carnot's cycle and derive the expression for its efficiency in terms of the temperatures of the source and sink. **(8)**

PART - B

Answer any **FIVE** questions. Each question carries **4** marks: **(5×4=20)**

9. A force of 10 N acts on a body of mass 1 kg lying on a table with the coefficient of static friction as 0.2 Calculate the frictional force and the acceleration of the body given $g = 10ms^{-2}$.

10. The earth is revolving round the sun in a circular orbit of radius with a time period of $3.15 \times 10^7 s$. Calculate the mass of the sun given $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

11. A spring has a force constant of $150 Nm^{-1}$. Find the work done to extend the spring by 7 mm from its relaxed position?

12. A metal sphere of surface area $500 cm^2$ at $827^0 C$ is placed in an enclosure at $327^0 C$. If the surface emissivity of the sphere is 0.5, find the heat radiated by the sphere per second given Stefan's constant $= 5.67 \times 10^{-8} Wm^{-2} K^{-4}$.

13. Calculate the mean free path of a gas having 1.5×10^{25} molecules per cubic metre with each molecule of diameter 4 $\overset{\circ}{A}$.

14. The critical pressure, temperature and volume of the gas are $1.316 \times 10^{11} Nm^{-2}$, $33.1 K$ and $6.56 \times 10^{-5} m^3$ per mole respectively, calculate the van der Waals constants of the gas.

15. Two moles of an ideal gas at 27^0 C expands adiabatically till the volume is doubled. Calculate the resulting temperature and the work done by the gas.

16. What is the entropy change of a 0.25 kg block of copper when its temperature is increased from 283 K to 293 K? Given specific heat of copper $= 388 J kg^{-1} K^{-1}$.

(3)   11121

PART - C

Answer any **FIVE** questions. Each question carries **2** marks: (5×2=10)

17. a)   Can a body remain at rest even though forces are acting on it? Explain.

   b)   Can you stop a car on a frictionless horizontal road by applying brakes? Explain.

   c)   Can kinetic energy be negative? Explain.

   d)   Two bodies of mass m and 2 m have equal momenta. Compare their kinetic energy.

   e)   What is the effect of temperature on the viscosity of

       i)   liquid   ii)   gas.

   f)   Distinguish between the term Vapour and Gas.

   g)   When a tyre bursts, the air coming out is cooler than the surrounding air. Explain the reason.

   h)   Does entropy remain constant during an isothermal process? Explain.

_____