11121

Reg. No. | | | | | | | | |

I Semester B.Sc. Degree Examination, March/April - 2022

PHYSICS

Mechanics - 1 (Heat and thermodynamics - 1)

Paper : I

(CBCS Repeaters 2018-19 and onwards prior to 2020)

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

1. Answer **five** questions from each part.
2. Non - programmable scientific calculators are permitted.

PART - A

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

1. a. Define coefficient of static friction and coefficient of sliding friction and angle of repose.

b. Obtain an expression for acceleration of a body sliding down a rough inclined plane. **(3+5)**

2. a. State Kepler's laws of planetary motion.

b. Derive an expression for orbital velocity of a satellite orbiting the planet. **(3+5)**

3. a. Define Centre of mass of system of particles.

b. Deduce Newton's second law of motion for system of particles. **(2+6)**

4. Deduce Planck's law of radiation. **(8)**

5. Obtain an expression for pressure exerted by gas molecules on the basis of kinetic theory of gases. **(8)**

6. a. Define critical temperature and critical pressure of a gas.

b. Derive expressions for critical constants of a gas in terms of Vanderwaals constants. **(2+6)**

7. a. State first law of thermodynamics.

b. Derive an expression for the work done by ideal gas during an adiabatic process. **(2+6)**

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8. a. Describe Cornot's heat engine.

   b. Derive an expression for the efficiency of cornot heat engine in terms of temperature of the source and the sink. (3+5)

PART - B

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

9. A small stone of mass 0.15 kg is falling slowly deep in the ocean with a terminal velocity $30ms^{-1}$. What force does water exert on the falling stone. Acceleration due to gravity, $g = 9.8ms^{-2}$. Neglect buoyancy.

10. Determine the escape velocity of the body from the moon. Take moon to be uniform sphere of radius 1.74×10^{6} m and mass 7.36×10^{22} kg. Given $G = 6.67\times10^{-11}\ Nm^2Kg^{-2}$.

11. A particle of mass 5 kg is moving with a velocity of $3ms^{-1}$ along x - axis and another particles of mass 8 kg is moving with a velocity of $-1ms^{-1}$ along X-axis find the velocity of centre of mass of the two particles.

12. Calculate the wavelength corresponding to maximum intensity radiation emitted from a furnace at 1500 K. Assume wien's constant to be $2.89\times10^{-3}mK$.

13. Calculate the mean free path of a gas molecule. Diameter of the molecule is $3\times10^{-10}m$ and number of molecules per unit volume is $2.7\times10^{25}\ m^{-3}$.

14. Calculate the pressure exerted by hydrogen if its density is $0.09\ Kgm^{-3}$ and rms speed of hydrogen molecules at that pressure is $1.84\times10^{3}\ ms^{-1}$.

15. One mole of an ideal gas is kept at O°C during an expansion from $3m^3$ to $10m^3$. How much work is done by the gas during this expansion. Given $R = 8.314Jk^{-1}mol^{-1}$.

16. When 0.04 Kg of ice at 273K melts into water at 320 K, Calculate the change in entropy. Given specific heat capacity of water is 4200 $JKg^{-1}K^{-1}$ and specific latent heat of ice is $3.36\times10^{5}JKg^{-1}$.

SECTION - C

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

17. a. Can a body remain at rest eventhough forces are acting on it? Explain.

    b. Is the speed of a planet same at all points on its orbit? Explain.

    c. Can centre of mass lie out side the body? Explain.

    d. A body with large reflectivity is a poor emitter - justify.

    e. Hydrogen escapes from the earth's atmosphere more rapidly than oxygen. Why?

    f. How permanent are the so called permanent gases like hydrogen and nitrogen.

    g. A crystal is an example of low entropy system. Justify.

    h. Entropy of universe always increases. Explain.
