# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **PHYSICS**

SECOND SEMESTER – **APRIL 2018**

**PH 2505– MECHANICS & STATISTICAL PHYSICS**

Date: 27-04-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

## PART – A

**Answer All Questions.** **(10 X 2 = 20 MARKS)**

1. When will a compound pendulum have a minimum time period?
2. State Graham's law for diffusion of gases.
3. What are holonomic and non-holonomic constraints?
4. Write down the mathematical equation that describes D'Alembert's principle.
5. Calculate the diameter of a molecule of benzene, if $\eta=2.79x10^{19}$ molecules per c.c. and mean free path $\lambda$ for benzene = $2.2x10^{-6}$ cm.
6. Explain transport phenomena.
7. How does the internal energy of an ideal gas differ from that of a real gas?
8. Differentiate first and second order phase transition.
9. State the condition for most probable distribution.
10. State any two limitations of Maxwell-Boltzmann statistics.

## PART – B

**Answer ANY FOUR Questions.** **(4 x 7.5 = 30 marks)**

11. Deduce the equation of continuity of flow. State Bernoulli's theorem and mention any two of its applications. **(5+1.5+1)**
12. Discuss the application of Lagrange's equation to a bead sliding on a uniform rotating wire. **(7.5)**
13. Derive an expression for thermal conductivity of a gas on the basis of kinetic theory of gases and state its relation to coefficient of viscosity. **(6.5+1)**
14. Explain Joule-Thomson effect using the Maxwell's thermodynamical relations and prove its absence for a perfect gas. **(6.5+1)**
15. Using Maxwell's law of distribution of speeds of molecules in a gas obtain expressions for average speed and root-mean square speed. **(4+3.5)**

## PART C

**Answer ANY FOUR questions** **(4 x 12.5 = 50 marks)**

16. Derive an expression for the time period of Bifilar pendulum which is suspended by equal and parallel strings. **(12.5)**

17. Obtain the Hamilton's equation of motion and discuss its application to describe the motion of a particle in a central force field. **(12.5)**

18. Derive an expression for the viscosity of a gas in terms of mean free path of its molecules. Show that it is independent of pressure but depends upon the temperature of the gas. Discuss the effect of pressure & temperature on $\eta$. **(10+2.5)**

19. Derive Maxwell's four thermodynamical relations. Use one of these to obtain Clausius – Clapeyron's latent heat equation. **(10+2.5)**

20. Applying Maxwell-Boltzmann distribution show that the internal energy of an ideal monoatomic gas depends only on its temperature. Derive the Maxwell-Boltzmann law of distribution of speeds. **(10+2.5)**

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