

**CARMEL COLLEGE OF ARTS, SCIENCE & COMMERCE FOR WOMEN,  
NUVEM-GOA**

**SEMESTER END EXAMINATION, JULY 2021**

**B.Sc Semester: II**                      **Heat & Thermodynamics and Properties of matter  
& Acoustics (PYC-102)**

**Max marks: 40      Date: 14-07-2021      Duration: 2hrs      Total No. of pages: 02**

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***Instructions:***

- 1) All questions are compulsory.*
- 2) However, internal choices are available.*
- 3) Use of log tables and non-programmable calculators is permitted.*
- 4) Symbols have their usual meanings unless specified.*

**Q1. Answer FIVE of the following (*minimum two from each section*):**

**(5 x 2 = 10)**

**Section 1**

- a) What is meant by the coefficient of performance of a refrigerator?
- b) Define Latent heat. State any one application of the Clausius Clapeyron equation.
- c) Define degree of freedom. State the law of equipartition of energy.
- d) At what temperature will the r.m.s. speed of the molecule of a gas be four times its value at N.T.P.?

**Section 2**

- e) A copper rod of cross-sectional area  $0.5\text{cm}^2$  and length 1m is elongated by  $2 \times 10^{-2}$  mm, and a steel rod of the same cross-sectional area but 0.1m in length is elongated by  $2 \times 10^{-3}$  mm. Which rod has greater *Longitudinal strain*?
- f) What is streamline and turbulent flow? Is Poiseuille's equation valid for both the flows? Explain
- g) What are ultrasonic waves? Why are they inaudible to a human?
- h) A lecture hall of dimension of 15m x 8m x 3m, has it's area of  $189\text{ m}^2$  heavily damped with sound absorbing material of absorption coefficient 0.3. Calculate the reverberation time.

**Q2.** Answer **SIX** of the following (*minimum three from each section*):

**(6 x 5 = 30)**

**Section 1**

- a) Derive an expression showing the variation of mean free path with temperature and pressure.
- b) Explain the temperature - entropy diagram of Carnot's cycle.
- c) Nitrogen at an atmospheric pressure of 101325 Pa and a temperature of 273.15 K undergoes isothermal compression to one tenth of its initial volume. Mass of nitrogen is 28 g. Determine the work performed by the gas, considering that its behavior is defined by the Van der Waals equation.
- d) Derive a relation between V and T in an adiabatic process.

**Section 2**

- e) For a cylindrical rod, fixed at the upper end and twisted at the lower end by applying a torque, derive an expression for couple per unit twist.
  - f) Deduce expression for the excess pressure inside i) *rain drop* and ii) *air bubble*, both are in contact with air.
  - g) A train is traveling at 24.0 m/s in still air. The frequency of the note emitted by the train whistle is 390 Hz? What is the frequency and wavelength of the sound heard by a stationary listener (i) in front of the train and (ii) behind the train respectively?
  - h) Suppose you are assigned a contract to construct an auditorium for Carmel college. Explain in detail the various requirements for a good auditorium? Is it ideal to have long reverberation time? Explain how it can be rectified.
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