Register Number:
Date:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27
M.Sc. PHYSICS - IV SEMESTER
SEMESTER EXAMINATION: APRIL 2019
PH0115 – EXPERIMENTAL PHYSICS II

Time- 2 1/2 hrs **Max. Marks-70**

This paper contains 2 printed pages and 2 parts.

Answer any **7** questions**.** **(7X10=70)**

Attempting 3 questions from each part is compulsory. Remaining 1 question can be selected from any part. Each question carries 10 mark.

Part-A

1. a) What is Knudsen number? Does it play any role in deciding the vacuum pump that you use for evacuating a particular chamber? Explain.
   b) Determine the fall in temperature of a paramagnetic salt produced by adiabatic demagnetisation when the sample initially magnetised with field 'H' of 5,000 oersted at temperature of 2K, is demagnetised. Specific heat at constant applied field 'H' i.e. C_H = 0.1 cal/g/K and Curie constant = 0.06 erg-K/g/ (oersted)^2. 1 cal = 4.18 Joules and 1 Joule = 10^7 erg. (5+5)

2. Given that an adiabatic process is an iso-enthalpic process. Starting from the given basic equation $dT = \frac{1}{C_p}\left[T\left(\frac{\partial V}{\partial T}\right)_p - V\right] dp$ where $dT and\ dp$ represent variation in temperature with variation in pressure and C_p represents specific heat at constant pressure, explain the thermodynamics of Joule-Thomson effect by deriving the equation to show how temperature varies with fall in pressure for real(Vander Waal) gases. Also, state conditions when it produces heating or cooling for these gases.

3. With neat diagram, explain the principle and working of Diffusion pump.

4. a) Why is stainless steel preferred as the material in construction of a cryostat?
   b) When making a joint of dissimilar materials in the cryostat, how is differential contraction taken care of?
   c) Why is Indium (In) widely used in making cryogenic seals? Explain.
   d) In two-stage cryo-refrigerator where the temperature of second stage is less than 20K, explain why is Lead preferred over Copper as regenerator material.
   e) Why do we need cryocoolers when we have cryogens like Liquid Helium to produce low temperatures? (2+2+2+2+2)

5. a) What are the two different types of Heat exchangers that can be used in cryocoolers? Explain.
   b) With diagram explain the principle and working of Gifford McMahon (GM) cryocooler. (3+7)

Part-B

6. Discuss in detail, the working principle and essential components of mass spectrometer with suitable diagram. Explain how the mass spectrometer works as leak detector.

7. (a) What are the differences between direct reading gauges and indirect reading gauges?

   (b) Describe the dynamics of glow discharge plasma. (3+7)

8. (a) What is vacuum evaporation? With neat sketch, explain the principle and construction of vacuum evaporation.
   (b) Mention the characteristic feature and limitations of vacuum evaporation. (7+3)

9. (a) What is an Atomic force Microscope? Explain the working principle of AFM.
   (b) Describe the different modes of AFM such as contact mode, non-contact and tapping mode. (4+6)

10. (a) With neat diagram, discuss the construction and principle of Scanning electron microscopy.
    (b) Explain the importance of Transmission Electron Microscope in nanostructures. (8+2)