



K17P 0404

Reg. No. :

Name :

Fourth Semester M.Sc. Degree (Reg./Supple./Imp.) Examination, March 2017
(2014 Admission Onwards)

PHYSICS

PHY4E12 : Experimental Techniques

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **both** questions (Either **a** or **b**) :

1. a) What are ion pumps ? With the help of a diagram, explain the various parts and working of a Sputter ion pump. What are the advantages of getter pumps ?

OR

- b) Give the principle of the technique of thermal evaporation for thin film preparation. What are the different methods used in this technique ? With the help of a neat diagram, describe the experimental set up Laser Evaporation Technique.

2. a) What are primary and secondary thermometers ? Describe with the help of a neat diagram, the principle and working of resistance thermometer.

OR

- b) Describe the principle of cyclotron. With the help of a neat diagram, explain how the magnetic field and radio frequency electric field helps in imparting energy to the ions in each half turn of the orbit. Give its limitations. (2×12=24)

SECTION – B

Answer **any four** (One mark for part **a**, 3 marks for part **b**, 5 marks for part **c**) :

3. a) What are flanges ?
b) Discuss with diagram a re-entrant liquid nitrogen trap.
c) Explain with diagram a hot filament ionization gauge.

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4. a) Give the velocity distribution curve of the atoms for thermal evaporation and sputtering.
- b) One mole of oxygen (assumed an ideal gas) expands at a constant temperature of 310 K from an initial volume of 12 litres to a final volume of 19 litres. Calculate the final pressure if the starting value is 2 atmospheres. If the gas were expanded adiabatically, calculate the final temperature and pressure achieved, given that the ratio of the specific heats of gas is 1.4.
- c) Write a note on multilayer optical filters.
5. a) What is Joule – Thomson effect ?
- b) List out the special properties of isotopes of helium.
- c) Briefly explain magnetic refrigerator.
6. a) Give the principle of linear electrostatic accelerators.
- b) A linear accelerator for the acceleration of protons to 45.3 MeV is designed so that, between any pair of accelerating gaps, the protons spend one complete radio frequency cycle inside a drift tube. The rf frequency used is 200 Mc/sec,
- a) What is the length of the final drift tube ?
- b) If the first drift tube is 5.35 cm long, at what KE are the protons injected into the linac ?
- c) Briefly explain Van de Graff Accelerator.
7. a) List the main nuclear processes useful for materials analysis.
- b) Explain the principle of neutron activation analysis.
- c) List the nuclear reactions useful for the analysis of Li, O and Be.
8. a) Give two applications of PIXE technique.
- b) Give the basic principle of PIXE technique.
- c) A narrow beam of Alpha particles with kinetic energy 1 MeV and intensity 10^{10} particles per second falls on a gold foil ($A = 197$) of thickness $1 \mu\text{m}$. Find the number of alpha particles scattered by the foil in 10 minutes through 30° - 40° . (4×9=36)
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