(i) Printed Pages: 4

(ii) Questions : 9

Roll No. .....

Sub. Code : 3722

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M.Sc. Physics 4th Semester

(2053)

EXPERIMENTAL TECHNIQUES IN PHYSICS

Paper : PHY–8041

Time Allowed : Three Hours] [Maximum Marks : 80

Note :—Attempt **FIVE** questions in all, selecting **ONE** question from each Unit. Question No. **9** in Unit V is compulsory.

UNIT—I

1. (a) How the heavy charge particles interact with matter ? Derive the Bethe Block formula for specific energy loss of charged particle in an absorber.

   (b) Find the value of Chi-square for a die thrown 132 times with the following results :

Number turned up	1	2	3	4	5	6
Frequency	16	20	25	14	29	28

   (c) Write a note on precision and accuracy of the experimental data. 10,3,3

2. (a) What do you mean by dead time of the counting system ? Discuss the various models proposed for dead time behaviour and how we can measure it using two-source method.

(b) Discuss the Normal or Gaussian Distribution of the statistical model.

(c) In a detector with Fano factor of 0.1 what should be the minimum number of charge carriers per pulse to achieve a statistical energy resolution limit of 0.5%. 8,4,4

UNIT—II

3. (a) Discuss the various design features of proportional counter. What are the factors effecting the energy resolution of this detector ?

(b) Discuss the various methods used for detection of slow neutron using (i) Nuclear and (ii) Boron reactions. 10,6

4. (a) Give the details of the types of configuration used in semiconductor radiation detector. Write down the applications of Ge detectors.

(b) Discuss the predicted gamma ray spectroscopy in case of intermediate size scintillator detector.

(c) Calculate the scintillation efficiency of anthracene if 1 MeV of particle energy loss creates 20,200 photons with average wavelength of 447 nm. 8,4,4

UNIT—III

5. (a) Write down the principle, instrumentation and working of Multi-Channel Analyzer (MCA). How it is better than Single Channel Analyzer (SCA) ?

(b) Give the experimental details and working of gamma-gamma coincident set up. How it is used to measure the absolute activity of radioactive source ? 10,6

6. (a) Write short notes on :

(i) Optical linear variable differential transformer (LVTD)

(ii) Magneto-restrictive transducer.

(b) What is a lock-in detector ? How it is used to improve the signal to noise ratio. 8,8

UNIT—IV

7. (a) Discuss the principle and instrumentation of pulsed laser beam physical vapor deposition technique. Mention its advantages and disadvantages.

(b) Explain the working of Molecular-Beam Epitaxy (MBE) method for thin-film deposition of single crystals. 10,6

8. (a) Give the principle, construction and working of Transmission Electron Microscope (TEM). What are the applications of TEM in material characterization ?

(b) Write down the principle and working of (i) heat flux and (ii) power compensated Differential Scanning Calorimeters (DSC). 10,6

UNIT—V

9. Attempt all **SIX** questions :

(a) How the electron interactions differ from heavy charged particle interactions with matter ?

(b) An electron and a photon have same wavelength, which one is more energetic ?

(c) What are background radiations and how their interference can be avoided ?

(d) Define thermal and epithermal neutrons.

(e) What is pole-zero cancellation in pulse shaping ?

(f) Write down the two advantages of Chemical Vapor Deposition (CVD) over Physical Vapor Deposition (PVD) technique used for thin films fabrication.

3,2,3,2,3,3