(i) Printed Pages: 4 Roll No. .....

(ii) Questions : 9 Sub. Code : 3722

Exam. Code : 0475

M.Sc. Physics 4th Semester

(2042)

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) Discuss the interaction of :—

   (i) fast neutron, and

   (ii) neutrino with matter.

   (b) Is pair production phenomena is possible in vacuum ? Calculate the energy and wavelength of the least energetic photon capable of producing electron-positron pair.

   (c) What do you mean by chi-square test ? Give its significance in experimental data interpretation.

6,4,6

2. (a) Write a note on :—

(i) Energy resolution

(ii) Detection efficiency

(iii) Dead time of radiation detector.

(b) If a random variable X follows a Poisson's distribution with mean 3.4, then find the value of $P(X = 6)$.

(c) Distinguish between Characteristics and Continuous X-rays. 8,4,4

UNIT—II

3. (a) Discuss the principle and working of position-sensitive proportional counters.

(b) Explain the function of the activator added in trace quantities to many inorganic scintillators. Why are they not needed to organic scintillators ? 10,6

4. (a) Explain the various configurations of semiconductor detectors in detail. How Germanium (Ge) detectors are different from Si(Li) detectors ?

(b) Write down the principle and working of Beta ray spectrometer. 8,8

UNIT—III

5. (a) Discuss the principles of CR and RC network in pulse shaping. How we can perform pole-Zero cancellation for undershoot of the pulse ?

   (b) Give the principle and working of Walk and Jitter technique in timing measurements. 10,6

6. (a) Draw the functional block diagram of multichannel channel analyzer (MCA). Explain its principle and working.

   (b) What are transducers and how they are classified ? Write down the principle and working of piezoelectric transducer. 10,6

UNIT—IV

7. (a) Give the principle, construction and working of scanning electron microscope (SEM). What are the advantages and disadvantages of this microscopic technique ?

   (b) Write a short note on dip coating method in thin film fabrication. Give the applications of this method in research. 10,6

8. (a) Discuss the principle, construction and working of atomic force microscope (AFM). Give the applications of AFM in material characterization.

   (b) Write down the principle of differential scanning calorimetry (DSC). Discuss the mechanisms of heat flux and power compensated DSCs. 8,8

UNIT—V

9. Attempt all **SIX** questions :—

(a) Explain the concept of precession and accuracy in data interpretation.

(b) What is minimum gamma-ray energy required to produce photo-neutrons in water from trace heavy water contents ?

(c) Why pair production phenomena for gamma-ray photon not occur in vacuum ?

(d) What are contact and non-contact operation modes of AFM ?

(e) Write down the various sources of background radiations in detector spectrum.

(f) Define specific heat and thermal conductivity of materials.

3,3,3,2,3,2