Exam.Code:0475
Sub. Code: 3724

2071

M.Sc. (Physics) Fourth Semester

PHY-7053: Experimental Techniques in Nuclear and Particle Physics

Time allowed: 3 Hours Max. Marks: 60

NOTE: *Attempt five questions in all, including Question No. IX (Unit-V) which is compulsory and selecting one question each from Unit I -IV.*

x-x-x

UNIT – I

I. a) Explain the meaning of accuracy and precision of experimental results with proper examples.

b) The two quantities x and y have an uncertainty δx and δy. Then calculate the error associated with in the expression $\frac{x^3}{y^5}$.

c) Write a short note on Gaussian distribution of experimental data. (3x4)

II. a) Obtain the expression for specific energy loss due to ionization and excitation for fast electrons. Why the energy lose by electron is much more complicated than the energy lose by ionization of heavy ions.

b) What are sources of background in radiation detectors? Discuss various conventional materials used for low-background and neutron shielding. (6,6)

UNIT - II

III. a) Discuss the principle and working of position sensitive proportional counter.

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

c) Assuming a decay constant of 250 nm, how much time is required for NaI(Tl) scintillator event to emit 99% of the total yield? (3x4)

IV. a) Explain the various configurations of Germanium (Ge) detectors in details. How they are different from Si(Li) detectors.

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

P.T.O.

UNIT - III

V. a) What do you mean by pulse shaping in nuclear instrumentation? How we can obtain Gaussian shape using CR-$(RC)^n$ network.

b) Discuss and explain the meaning of Walk and Jitter.

c) Distinguish between voltage and charge sensitive preamplifiers. (3x4)

VI. a) Write down the experimental details and working of Gamma- gamma coincidence set up.

b) Explain the function of (i) Time pickoff module and (ii) time to amplitude converter (TAC) in modular instrumentation in time measurements. (6,6)

UNIT - IV

VII. a) Write a note on Doppler Shift Attenuation Method (DSAM) technique used for lifetime measurements of the excited nuclear levels using in beam gamma ray spectroscopy.

b) Give the principle and experimental details of Heavy Ion Reaction Analyzer (HIRA). Which type of experimental measurements we can performed using this set-up. (6,6)

VIII. a) Describe briefly the ALICE experimental setup available at the CERN Large Hadron Collider to study Heavy-ion physics.

b) Discuss the working of electron spectrometer. (6,6)

UNIT - V

IX. Attempt any six of the following:-

a) How many 5 MeV alpha particles are required to deposit a total energy of 1 J?

b) The background gamma-ray spectrum inside massive concrete shielding normally shows a prominent 2.22 MeV line. Explain the origin of these gamma rays.

c) Define Straggling effect exhibit by interaction of heavy charge particle with matter.

d) Why Ge and Si(Li) detector dewars are always filled with Liquid Nitrogen.

e) What are advantages of Bismuth Germanate (BGO) scintillator over many other scintillators?

f) Define pole zero correction in pulse shaping.

g) What is the function of multiplicity filters in heavy-ion reactions detection system? (6x2)

x-x-x