MANIPAL UNIVERSITY

Deemed- to -be -University under Section 3 of the UGC Act, 1956

Reg. No.										

DEPARTMENT OF SCIENCES, M.Sc. (PHYSICS)
III SEMESTER - END SEMESTER EXAMINATIONS, JUNE 2017

SUBJECT: NUCLEAR PHYSICS I [PHY-707.5]

(REVISED CREDIT SYSTEM)

Time: 3 Hours Date: MAX. MARKS: 50

Note: (i) **Answer Any FIVE full questions. Each sub questions carries FIVE marks.**

1. (a) What are experimental characteristics of beta ray continuum? [5]

   (b)Explain "Energy Straggling" with help of plots of energy distribution of a beam of initially mono energetic charged particles at various penetration distances. [5]

2. (a) Explain major interaction mechanism of gamma radiation with matter. [5]

   (b) What is scintillation process? Explain working principle of inorganic scintillation radiation detector? [2+3]

3. (a) Explain the origin of different regions in a typical gamma ray spectrum obtained for Cs-137 source. [5]

   (b) Why Ge (Li) radiation detectors have to be kept at liquid Nitrogen temperature. What potential must be developed across the capacitor of capacitance 300 µF in a Si detector, by the absorption of 5 MeV alpha particles which produces one ion pair for each 3.5 eV expended? [2+3]

4. (a) Sketch and explain decay scheme of Co-60 radioisotope. [5]

   (b) Explain the role of the activator added in trace quantities to many inorganic scintillators. Assuming the decay constant of 230 ns, how much time is required for NaI (Tl) scintillation event emit 99% of the total light yield. [2+3]

5. (a) Explain mass spectroscopic method of approach to the observation of double beta decay with an example. [5]

   (b) Mono energetic 450-keV gamma rays are absorbed in a NaI(Tl) crystal having an efficiency of 12%. Seventy-five percent of the scintillation photons, which have an average energy of 2.8 eV, reach the cathode of a photomultiplier tube, which converts 20% of the incident photons

into photoelectrons. Assume that variations in the pulse heights from different gamma photons are entirely due to statistical fluctuations in the number of visible photons per pulse that reach the cathode. (a) Calculate the average number of scintillation photons produced per absorbed gamma photon. (b) How many photoelectrons are produced, on the average, per gamma photon? [5]

6. (a) Explain activation method of neutron flux measurement.

(b) Explain conduction band – valence band model for the "Readout" phase of thermo luminescence mechanism (TLD). A 2.6 MeV neutron has a collision with hydrogen. If neutron loses 0.75 MeV, at what angle is it scattered. [2+3]

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