

國 立 清 華 大 學 命 題 紙

八十七學年度 工程與系統科學 系(所) _____ 組碩士班研究生入學考試

科目 核輻射度量 科號 4004 共 1 頁第 1 頁 *請在試卷【答案卷】內作答

共五題,每題20分

1. Please plot out the structure and describe the operation principle of a scintillation detector to measure the spectrum of a gamma ray source.
2. A particular counting system has an absolute detector efficiency of 0.15 ± 0.01 for 663 keV gamma rays. Now, I have a ^{137}Cs source which emits gamma rays with the energy of 663 keV and the branching ratio of 85%. If I put the source into the counting system and measured for 10 min. The total counting was 1600 counts. Then, I took the source out and measured the background for 40 min and obtained a background of 400 counts. Please tell me the activity (in Ci) of the ^{137}Cs source. ($1\text{Ci}=3.7 \times 10^{10}$ disintegration/sec). What is the error bar of activity?
3. One of the major purpose of linear amplifier is pulse shaping. What is the purpose of pulse shaping in a radiation counting system? Assuming that the pulse shaping was achieved by CR-RC shaping circuits.
4. A gas proportional counter has an electron multiplication factor of 10,000 times and the W-value to create an electron-ion pair is 20 eV. What is the maximum output pulse height voltage for a 10 keV photon if the detector has a capacitance of 1 pF. ($1 e = 1.6 \times 10^{-19} \text{ C}$)
5. A beam of 10 keV photons is incident into an ion chamber and all the photons are absorbed in the active region. The current output of the ion chamber is 10 nA. Please tell me what is the intensity of the photon beam (in photons/sec). (The W-value to create an electron-ion pair is 20 eV). What will the current output of the ion chamber changed as the bias voltage of the ion chamber slowly decrease to zero (Will the current output proportional to the bias voltage?)