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**Nuclear Instrumentation and Measurement**

**0407204, Fall 2024-25**

**Midterm Exam**

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| **Instructor:** | **Dr. Muhammad Zubair** |
| **CRN:** | **11582** |
| **Section:** | **11** |
| **Date and Time:** | **October 14, 2024, 2:00– 3:00 PM** |
| **Place:** | **M10-004** |

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| Student Name: |  | **ID:** |  |

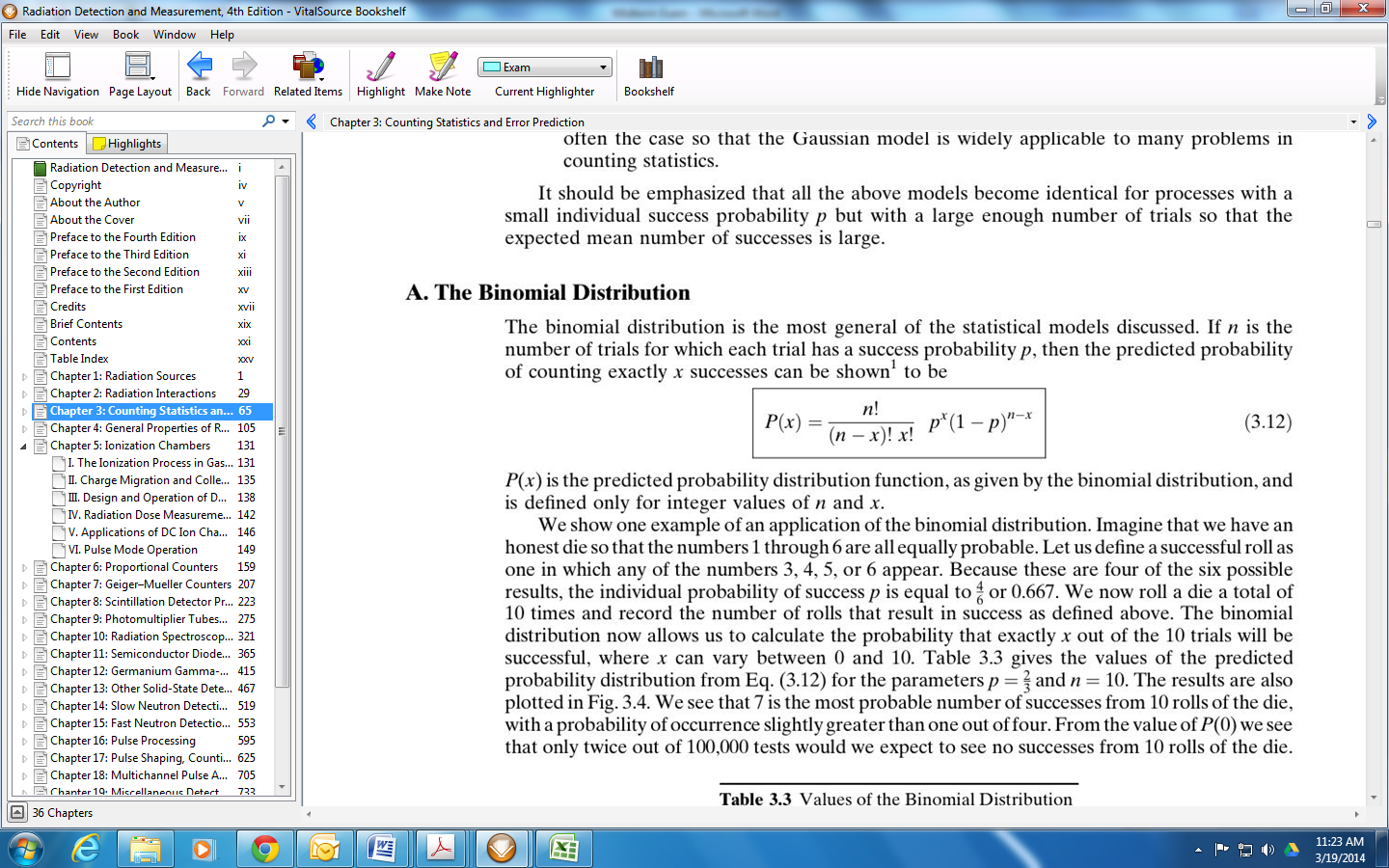
**Grading**

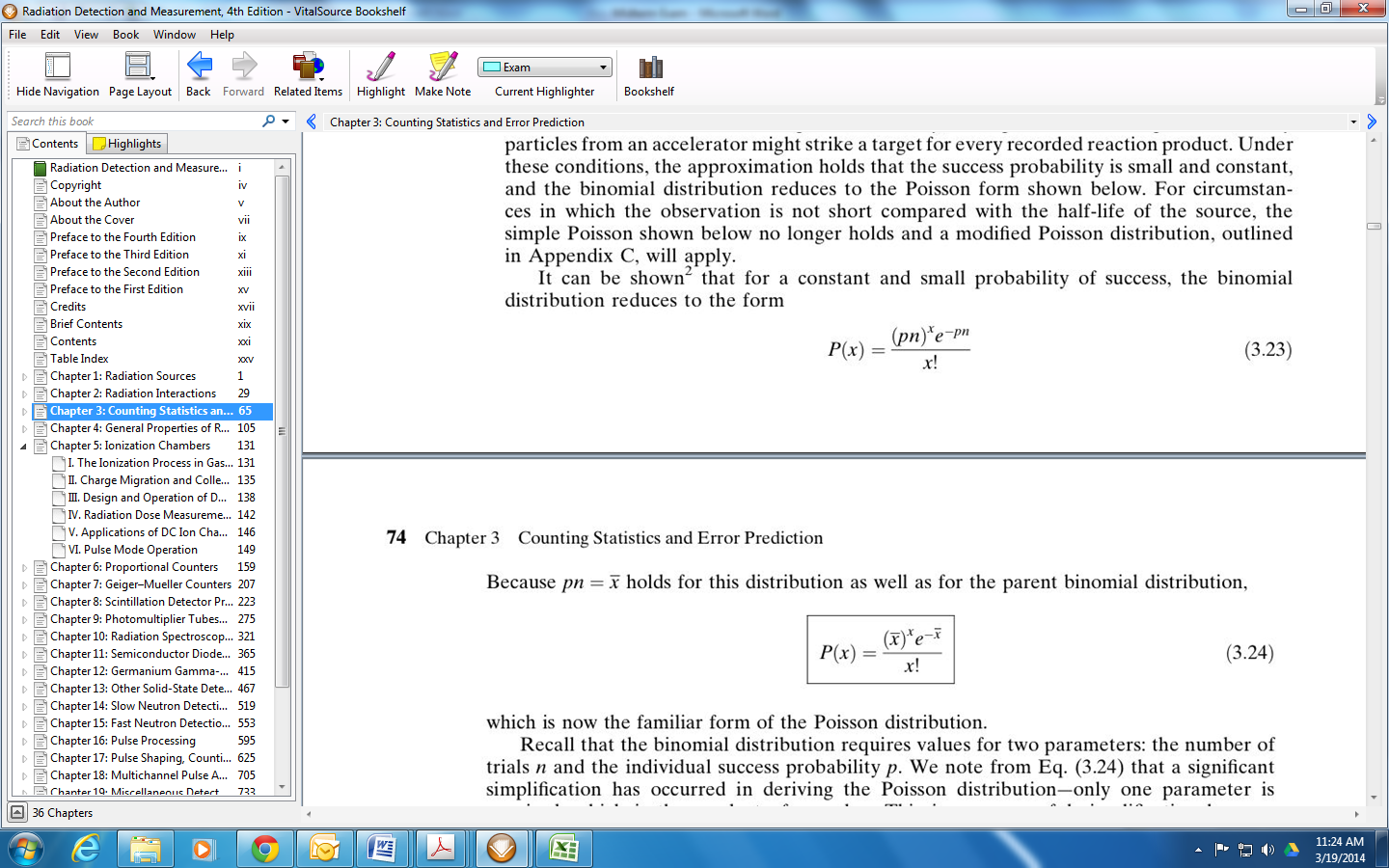
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| **Q1** | **Q2** | **Q3** | **Total** |
| **10** | **10** | **10** | **30** |
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**Useful Data:**

1 amu=1.6605x10-27 kg, 1 amu ≡ 931.48 MeV, 1 eV = 1.6022 × 10-19 J , me = 0.0005486 amu

235U = 235.0439, 117Sn = 116.9029, 118Sn = 117.9016





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**Answer all of the following questions:**

**Question #1 (5+5 Points):**

1. For each of the radiation sources listed below, indicate whether "discrete" or "continuous" is a better description:
2. Conversion electrons
3. Auger electrons
4. Fission fragments
5. Bremsstrahlung
6. Annihilation radiation

**Discrete: i, ii, v**

**Continuous: iii, iv**

1. Using the reaction below, find the energy released by the spontaneous fission of 235U into two equal-mass fragments.

235U 🡪 117Sn + 118Sn



**Question #2 (5+5):**

1. Calculate the mean free path of 1 MeV gamma rays in sodium iodide (specific gravity= 3.67, and the mass attenuation coefficient is 0.06 cm2/gm).



1. What fraction of 2-MeV betas will go through a single Al (density = 2.7x103 kg/m3) foil of thickness 0.1 mm? Where; μ = 0.7714 m2/Kg

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**Question #3 (5+5 points):**

1. A 10-min count of a source+ background gives a total of 846 counts. Background alone counted for 10 min gives a total of 73 counts. What is the net counting rate due to source alone, and what is its associated standard deviation?

A paper with writing on it

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1. Explain in your words the term, “Minimum Detectable Activity”.

The minimum detectable activity (MDA) is the smallest net count that can be reported with a certain degree of confidence that represents a true activity from a sample and is not a statistical variation of the background.