

## **PH3105: Mark Distribution Guideline**

**Expt-1:**     *Study of Geiger-Muller Counter and counting statistics by  $\gamma$ -ray source.*

**Total 10 Marks**

- |      |   |                |
|------|---|----------------|
| i.   | Theory of GM Counter.   | <i>1 Mark</i>  |
| ii.  | Data Table [Run 1, Run 2, min 15-20 data points from 0 V to $A_v$ Voltage].     | <i>3 Marks</i> |
| iii. | GM Characteristic Curve with proper leveling.                                   | <i>2 Marks</i> |
| iv.  | Calculation of $\mu$ and $\sigma^2$ from the data for distribution curve.       | <i>2 Marks</i> |
| v.   | Use the $\mu$ and $\sigma^2$ to plot the Gaussian on the histogram and compare. | <i>2 Marks</i> |

**Expt-2:**     *Study of  $\gamma$ -ray absorption in matter and inverse square law by  $\gamma$ -ray source.*

**Total 10 Marks**

- |      |   |                |
|------|---|----------------|
| i.   | Theory of GM Counter, Mass attenuation, $\mu$ and inverse square law.   | <i>1 Mark</i>  |
| ii.  | Background Reading.   | <i>1 Mark</i>  |
| iii. | Determination of Mass attenuation coefficient [Table with 2 RUN, Graph:<br>Count Rate vs Thickness for all available range] | <i>4 Marks</i> |
| iv.  | Calculation of half value thickness.  | <i>1 Mark</i>  |
| v.   | Verification of inverse square Law.   | <i>2 Marks</i> |
| vi.  | Write possible errors associated with your expt.  | <i>1 Mark</i>  |

**Expt-3:** *Study of  $\gamma$ -ray energy spectrum using a scintillation counter with Single Channel Analyzer (SCA).*

**Total 10 Marks**

- |      |   |         |
|------|---|---------|
| i.   | Theory: Gamma-ray interaction with matter.  | 1 Mark  |
| ii.  | Theory: Scintillation Energy Detector.  | 1 Mark  |
| iii. | Data Table with proper window and baseline step size  | 2 Marks |
| iv.  | Two RUNs of counts for averaging data.  | 2 Mark  |
| v.   | Pulse height analysis of the expt.  | 1 Mark  |
| vi.  | Graph Plotting with proper marking of backscattering peak, Compton Edge, Photo peak and its relating with pulse height observed in CRO. | 3 Mark  |

**Expt-4:** *Analysis of  $\gamma$ -ray energy spectra with Multichannel analyzer (MCA).*

**Total 10 Marks**

- |      |  |         |
|------|--|---------|
| i.   | Detail decay scheme with explanation of $\text{Co}^{60}$ and $\text{Cs}^{137}$ source.                   | 2 Marks |
| ii.  | $\text{Co}^{60}$ and $\text{Cs}^{137}$ energy spectra and its calibration.                               | 2 Marks |
| iii. | Table: Variation of resolution for $\text{Co}^{60}$ with PMT voltage                                     | 2 Marks |
| iv.  | Peak fitting of $\text{Co}^{60}$ with two Gaussian peaks + Non-linear Background (2 <sup>nd</sup> order) | 2 Marks |
| v.   | Plot: Resolution vs voltage.   | 2 Marks |

**Expt-5:**    *Study of beta-spectroscopy.*

**Total 10 Marks**

- |      |   |                |
|------|---|----------------|
| i.   | Describe the functioning of a beta spectrometer.                                      | <i>2 Marks</i> |
| ii.  | Detail decay scheme with explanation of $\text{Sr}^{90}$ and $\text{Na}^{22}$ source. | <i>2 Marks</i> |
| iii. | Derive beta-particle kinetic energy, $E_{\text{kin}}$ formula.                        | <i>2 Marks</i> |
| iv.  | Table: For $\text{Sr}^{90}$ source (as per manual).                                   | <i>1 Mark</i>  |
| v.   | Plot: Counts vs $E_{\text{kin}}$ for $\text{Sr}^{90}$ source.                         | <i>1 Mark</i>  |
| vi.  | Table: For $\text{Na}^{22}$ source (as per manual).                                   | <i>1 Mark</i>  |
| vii. | Plot: Counts vs $E_{\text{kin}}$ for $\text{Na}^{22}$ source.                         | <i>1 Mark</i>  |