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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 03-01-2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** B.Tech (MEC) |
| **Course Code :** MEC3012 | **Course Name :** Material and Characterization Techniques |
| **Semester**: V | **Max Marks**: 100 | **Weightage**: 50% |

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| --- | --- | --- | --- |
| **CO - Levels** | **CO1** | **CO2** | **CO3** |
| **Marks** | **30** | **30** | **40** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

|  |
| --- |
| **Answer ALL the Questions. 10 x 2 Marks=20 Marks** |
| **1** | Define Depth of Field. | **2 Marks** | **L1** | **CO1** |
| **2** | Define Chromatic Aberration. | **2 Marks** | **L1** | **CO1** |
| **3** | Mention two types of Interaction between electron beam and specimen in Electron microscopy. | **2 Marks** | **L1** | **CO1** |
| **4** | What is an optical microscope? | **2 Marks** | **L1** | **CO1** |
| **5** | What is thickness contrast in TEM? | **2 Marks** | **L1** | **CO1** |
| **6** | Define resolution. | **2 Marks** | **L1** | **CO2** |
| **7** | Name two types of target materials used in the generation of X-rays. | **2 Marks** | **L1** | **CO2** |
| **8** | Name two types of electron sources. | **2 Marks** | **L1** | **CO2** |
| **9** | Define Braggs Law. | **2 Marks** | **L1** | **CO2** |
| **10** | Mention two conditions that can improve resolving power w.r.t. Rayleigh criterion. | **2 Marks** | **L1** | **CO2** |

**Part B**

**Answer the Questions Total 80 Marks**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **11.** | 1. Explain the steps involved in sample preparation for the optical system
 | **20 Marks** | **L2** | **CO3** |
| OR |
| **12.** | 1. Write down the steps involved in the linear intercept method to determine grain size. [10 M]
2. Explain Rayleigh’s criteria for resolution. Mention the conditions for obtaining the best resolution for the optical system. [10 M]
 | **20 Marks** | **L2** | **CO3** |
|  |  |  |  |  |
| **13.** | 1. Mention all the factors on which the intensity of your X-ray powder diffraction depends. [10 M]
2. Explain the generation of X-rays. [10 M]
 | **20 Marks** | **L3** | **CO2** |
| OR |
| **14.** | 1. Write down the steps needed for indexing miller indices of planes. Mark (110),(111), (220), (222), (400). [10 M]
2. Calculate the position of the image and its magnification when an object is held 10 cm from a convex lens of a focal length of 8 cm. [10M]
 | **20 Marks** | **L3** | **CO2** |

|  |  |  |  |  |
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| **15.** | 1. Explain the working principle of the Electron gun in electron microscopy. [10 M]
2. Explain elastic and inelastic interaction in electron microscopy with the help of diagrams**.** [10M]
 | **20 Marks** | **L3** | **CO3** |
| **OR** |
| 16. | A Debye–Scherrer tungsten pattern is made with Cu Ka(1.54 Å) radiation. The first four lines on this pattern were observed to have the following $2θ$ values: Determine the structure of the materials.

|  |  |
| --- | --- |
| Line | 2$θ$ |
| 1 | 40.6 |
| 2 | 58.4 |
| 3 | 73.4 |
| 4 | 87.2 |

 | **20 Marks** | **L3** | **CO3** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 17. | Write down seven crystal systems and 14 Bravais lattices. Draw a figure for each Bravais lattice. | **20 Marks** | **L3** | **CO1** |
| **OR** |
| 18. | 1. Mention all the factors on which the intensity of your X-ray powder diffraction depends. [10 M]
2. Explain briefly the scattering of electrons by atom and unit cell respectively. [10 M]
 | **20 Marks** | **L3** | **CO1** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***