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**PRESIDENCY  
UNIVERSITY**

**BENGALURU**

**School of Engineering**

**Mid-Term Examinations - November 2024**

**Semester: V**

**Date: 04-11-2024**

**Course Code: MEC3012**

**Time: 09:30am – 11:00am**

**Course Name: Materials and Characterization Techniques**

**Max Marks: 50**

**Program: B.Tech.**

**Weightage: 25%**

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**Instructions:**

*(i) Read all questions carefully and answer accordingly.*

*(ii) Do not write anything on the question paper other than roll number.*

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**Part A**

**Answer ALL the Questions. Each question carries 2marks.**

**2Mx5Q=10M**

- |   |                                 |         |    |     |
|---|---------------------------------|---------|----|-----|
| 1 | Define Rayleigh criteria        | 2 Marks | L1 | CO1 |
| 2 | What are filters?               | 2 Marks | L1 | CO1 |
| 3 | Define electromagnetic wave.    | 2 Marks | L1 | CO2 |
| 4 | What are chromatic aberrations? | 2 Marks | L1 | CO2 |
| 5 | What is radiography?            | 2 Marks | L1 | CO1 |

**Part B**

**Answer ALL Questions. Each question carries 10 marks.**

**4QX10M=40M**

- |    |    |  |         |    |     |
|----|----|--|---------|----|-----|
| 6a | 6a | What are aberrations in microscopy?                  | 5 Marks | L2 | CO1 |
| 6b | 6b | Differentiate between resolution and magnifications. | 5 Marks | L2 | CO1 |

**or**

- |   |   |  |          |    |     |
|---|---|--|----------|----|-----|
| 7 | 7 | How many convex lenses, with a focal length of 1 mm and object distance (u) 1.1 mm, are needed to give a final image with magnification 1 million times? | 10 Marks | L3 | CO1 |
|---|---|--|----------|----|-----|

**8** Write down the steps needed for indexing miller indices of planes. Mark (100), (101), (200), (201), (400) planes in cubic unit cell. **10 Marks** **L2** **CO2**

**or**

**9** Derive simplified expressions for structure factor (F) for face centered cubic. This unit cell contains 4 atoms, located in the following positions: **10 Marks** **L3** **CO2**

$$(000) \left(0 \frac{1}{2} \frac{1}{2}\right) \left(\frac{1}{2} 0 \frac{1}{2}\right) \left(\frac{1}{2} \frac{1}{2} 0\right)$$

**10a** Draw the ray diagram for the metallurgical microscope. **5 Marks** **L2** **CO1**

**10a** 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. **5 Marks** **L2** **CO1**

**10b**

**or**

**11** Draw the following planes and directions in a tetragonal unit cell: (001), (011), (113), [110], [201], [310]. Show cell axes. **10 Marks** **L2** **CO1**

**12** A Debye–Scherrer pattern of tungsten is made with Cu-K radiation. The first four lines on this pattern were observed to have the following  $2\theta$  values: Determine the structure of the materials. **10 Marks** **L3** **CO2**

Line	$2\theta$
1	40.6
2	58.4
3	73.4
4	87.2

**or**

**13** Describe the steps involved in the preparation of samples for the optical microscopy. **10 Marks** **L3** **CO2**