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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## May 2023 Semester End Main Examinations

**Programme: B.E.** **Semester: III**
**Branch: Mechanical Engineering** **Duration: 3 hrs.**
**Course Code: 22ME3PCMSM / 19ME3DCMSM** **Max Marks: 100**
**Course: Material Science and Metallurgy** **Date: 08.05.2023**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may suitably be assumed.





### UNIT - I

1 a) With a neat figure, explain linear imperfections. **10**

b) With the help of stress-strain plot, explain the elastic and plastic properties of Mild Steel material. **10**

**OR**

2 a) Explain and derive an expression for Griffith criteria? **10**

b) With neat diagrams explain a creep and SN curve. **10**

### UNIT - II

3 a) With neat sketch explain homogenous and heterogeneous nucleation process? **10**

b) With suitable example, explain Hume Rothery rules for the formation of solid solutions? **10**

**OR**

4 a) Pure copper melts at $1085^0$C and pure silver melts at $962^0$C. They form eutectic solution at $779^0$C with 71.9 % of silver. The solid solubility of silver in copper is at maximum of 8 % of silver at $779^0$C and decreases to 0% at $300^0$C. The solid solubility of copper in silver is at maximum of 91.2 % of silver at $779^0$C and decreases to 0% at $300^0$C. Assuming one solidus joining from $1085^0$C with 0% of silver to 8.0 % of silver at $779^0$C and similarly other starting at 100% silver at $962^0$C and ending at 91.2% of silver at $779^0$C. Assuming all the lines are straight, draw this phase diagram and show all the phases on it. Also carry out the interpretation of the phase diagram at eutectic point. Show the microstructure diagrams at the eutectic point and at points above and below the eutectic point. **12**

b) Explain with a neat sketch eutectic phase diagram? **08**

### UNIT - III

5 a) Draw a neat iron-cementite phase diagram and explain the same. Also, state the three invariant reactions with their compositions and temperature? **12**

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| | b) | Explain the construction of TTT diagram and also explain the TTT diagram for eutectoid steel | **08** |

**UNIT - IV**

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| 6 | a) | Explain in detail the annealing, normalizing, hardening and tempering heat treatment processes | **10** |
| | b) | Explain the precipitation hardening process for nonferrous materials. | **10** |

**UNIT - V**

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| 7 | a) | Define composite materials. Give their classifications and state the applications of composite materials. | **10** |
| | b) | Explain with sketch pultrusion and filament winding process for composites manufacturing. | **10** |

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