

Basavarajeswari Group of Institutions  
**BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT**  
 (Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code 

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Third Semester B.E. Degree Examinations, March/April 2024  
**MATERIAL SCIENCE AND METALLURGY**

Duration: 3 hrs

Max. Marks: 100

**Note:** 1. Answer any FIVE full questions choosing ONE full Question from each Module.  
 2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO: PI)</u>
<b><u>MODULE – 1</u></b>			
1.	a. Draw stress –strain diagram for mild steel and explain properties in the elastic and plastic region.	10	(1 :1: 1.6.1)
	b. With neat sketch explain plastic deformation by slip and twinning	10	(2 :1: 1.6.1)
<b>OR</b>			
2.	a. Explain the Fick's 1 <sup>st</sup> and 2 <sup>nd</sup> laws of diffusion, and factors affecting the atomic diffusion.	12	(2 :1: 1.6.1)
	b. A low carbon steel rod is subjected to a tensile load of 70000 kg. Determine engineering stress, strain, true stress and true strain. The initial diameter of rod is 13 mm and the specimen under the load is 12 mm.	08	(2 :1: 1.7.1)
<b><u>MODULE – 2</u></b>			
3.	a. Define fracture and explain ductile and brittle fractures with sketch.	10	(2 :2: 1.6.1)
	b. What is fatigue? Explain fatigue testing for aluminium and mild steel with S-N diagram.	10	(2 :2: 1.6.1)
<b>OR</b>			
4.	a. Explain different types of fatigue load cycles with sketches and give examples.	10	(2 :2: 1.6.1)
	b. Define creep. With a neat sketch explain 3 stages of creep process.	10	(2 :2: 1.6.1)
<b><u>MODULE – 3</u></b>			
5.	a. Explain Mechanism of solidification with neat sketches.	10	(1 :3: 1.6.1)
	b. What is solid solution? Discuss Hume-Rothery rules for formation of solid –solution.	10	(3 :3: 1.7.1)
<b>OR</b>			
6.	a. Draw a neat Iron- Carbon equilibrium diagram and label all phases and write invariant reactions.	10	(2 :3: 1.6.1)
	b. Derive an expression for critical radius in homogeneous nucleation and discuss the significance of this critical radius.	10	(2 :3: 1.6.1)
<b><u>MODULE – 4</u></b>			
7.	a. Explain annealing, normalizing and hardening heat treatment processes with neat sketches.	10	(2 :4: 1.6.1)
	b. Draw TTT diagram for Eutectoid (0.8%C) steel and explain phases in it.	10	(2 :4: 1.6.1)

**Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI- Performance Indicator)**

**OR**

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| <b>8.</b> | <b>a.</b> Explain Austempering and Martempering with neat sketches. | <b>12</b> | (2 :4: 1.6.1) |
|           | <b>b.</b> With neat sketch explain the flame hardening method.      | <b>08</b> | (2 :4: 1.6.1) |

**MODULE – 5**

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| <b>9.</b> | <b>a.</b> Explain the composition, properties, and applications of low, medium and high carbon steels.                   | <b>10</b> | (2 :5: 1.6.1) |
|           | <b>b.</b> Define composites. With neat sketch explain stir casting process for production of metal matrix composite(MMC) | <b>10</b> | (2 :5: 1.6.1) |

**OR**

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|------------|--|-----------|---------------|
| <b>10.</b> | <b>a.</b> With help of neat sketch explain injection moulding process for PMCs.                  | <b>10</b> | (2 :5: 1.6.1) |
|            | <b>b.</b> Explain ‘pultrusion’ process for manufacturing of polymer composites with neat sketch. | <b>10</b> | (2 :5: 1.6.1) |

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