

Exam Date & Time: 17-Jan-2024 (02:30 PM - 05:30 PM)



# MANIPAL ACADEMY OF HIGHER EDUCATION

DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING  
VII SEMESTER B.TECH. (MECHANICAL)  
SUBJECT: THERMAL TREATMENT OF METALS AND ALLOYS (MME 4308)  
END SEMESTER MAKEUP EXAMINATION- JAN 2024

## Thermal Treatment of Metals and Alloys [MME 4308]

**Marks: 50**

**Duration: 180 mins.**

### Descriptive

**Answer all the questions.**

ANSWER ALL QUESTIONS

- 1A) With a neat sketch explain the Grossman's critical diameter method for the determination of hardenability (5)
- 1B) With a suitable heat treatment cycle explain the difference between hardening and normalising treatment (3)
- 1C) With the help of Time-Temp-Transformation diagram, explain the process of transitioning from the Austenite to the Pearlite phase (2)
- 2A) With sketch briefly explain the various phases exist in Iron-Carbon (Fe-C) equilibrium diagram (5)
- 2B) Briefly summarise the difference between Thermo-mechanical and Thermo-chemical heat treatment process (3)
- 2C) Explain the process of Full annealing heat treatment with suitable heat treatment cycle (2)
- 3A) Describe with sketch the heat treatment procedure for Induction hardening (4)
- 3B) Explain the thermo-chemical treatment process of liquid carburising and pack carburizing methods (4)
- 3C) List the benefits and drawbacks that should be considered while carrying out Flame hardening treatment process (2)
- 4A) Explain with sketch, solutionising and aging heat treatment for non-ferrous materials using an appropriate heat treatment cycle (4)
- 4B) With the help of suitable heat treatment cycle explain the importance of Iso forming and cryo-forming thermo-mechanical treatment techniques (4)

- 4C) Briefly explain importance of bearing steel (2)
- 5A) Write the specification of AISI 4120 (4: Molybdenum) and AISI 5180 (5: Chromium steel) and Explain the following defects associated with heat treatment i) Blow holes ii) Distortion (4)
- 5B) Write a note on i) Gray cast Iron ii) Stainless steel (3)
- 5C) Briefly explain importance of i) Titanium alloy ii) White cast Iron (3)

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