

Code: 20ES1303

II B.Tech - I Semester – Regular Examinations - FEBRUARY 2022

**MATERIAL SCIENCE AND METALLURGY
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) What are the differences between metals and alloys ? 7 M
Give at least one example for metals and alloys.
- b) Differentiate Frenkel defect between Schottky defect 7 M
with suitable sketch.

OR

2. a) Write the names of important point defects and write 7 M
about each one of them.
- b) Mention different types of Bravais lattices possible in 7 M
crystalline materials. Show the atomic packing factor
(APF) of FCC crystal structure is 0.74

UNIT – II

3. a) What is solid solution? Discuss various types of solid 7 M
solution.
- b) Name the phase reactions occurring in Fe-Fe₃C system. 7 M
What are the temperatures and compositions at which
they occur?

OR

4. a) Enumerate on the need for alloying. State Hume Rothery rules for substitutional solid solution. 7 M
- b) Explain the solid solution strengthening and dispersion strengthening mechanisms with practical example. 7 M

UNIT-III

5. a) What are CCT diagrams? Explain the construction of CCT diagrams. 7 M
- b) Describe how the process of normalizing is undertaken and indicate a reason why this process is more commonly used in industry than full annealing? 7 M

OR

6. a) Give a detailed account on annealing, normalizing, austempering and case hardening. 7 M
- b) What do you understand by hardening of steel? Discuss the reason why martensite is very hard. Also discuss the various characteristics of martensite transformation. 7 M

UNIT – IV

7. a) Explain principle characteristics of cast iron and explain the factors which affect the structure of cast iron. 7 M
- b) Describe the properties and application of low medium and high carbon steels. 7 M

OR

8. a) Explain the purpose of alloying steels with suitable examples from industrial applications. 7 M

- b) Write down the composition, properties and applications of the following metals. (i) Grey cast iron (ii) nodular cast iron (iii) malleable cast iron. 7 M

UNIT – V

9. a) Write a short note on Gun Metal, Naval Brass, Bell Metal. 7 M
- b) What is a Composite material and explain the classification of Composite materials with neat sketch. 7 M

OR

10. a) Discuss on different types of Titanium alloys – highlight the general characteristics and applications. 7 M
- b) Differentiate between the Particle-reinforced and fibre reinforced composite materials. 7 M