



Reg. No. :

Name :

**Fourth Semester B.Tech. Degree Examination, May 2015
(2013 Scheme)**

**13.404 : METALLURGY AND MATERIAL SCIENCE
(MNPU)**

Time : 3 Hours

Max. Marks : 100

Instruction : Answer **all** questions from Part **A** and **one full** question from **each** Module of Part **B**.

PART – A

(10×2= 20 Marks)

1. Discuss the effects of surface defects on crack initiation.
2. How the slip system can be used for explaining brittleness of BCC and HCP and ductility FCC ?
3. What are effects of low angle and high angle grain boundary for crossing a dislocation across the grain boundary ?
4. What is the driving force for steady state diffusion ?
5. Explain the significance of dislocation density to a guitar wire
6. Explain the endurance limit with neat sketch.
7. What are the conditions for martensite formation ?
8. Correlate the structure of tempered martensite with properties.
9. Sketch and explain the importance of "polymorphic transformation temperature".
10. Differentiate between Nickel steel and Chromium steel.



PART – B

(4×20= 80 Marks)

Module – 1

11. a) What are the attributes of crystalline and non-crystalline structures ? Explain with neat sketches the effect of crystalline and amorphous structure on mechanical strength ? 10
- b) Explain various steps involved in metallographic specimen preparation. What is etching ? Explain any one method used for grain size determination. 10

OR



12. What is Hall-Petch relation ? Explain with neat sketches the effect of fine and coarse grain sizes on mechanical strength at room temperature and elevated temperature.

Module – 2

13. A small hole is drilled through a steel plate ahead of a crack, whether it can stop the crack's progress until repairs can be made. Explain in detail and derive the equation for the principle.

OR

14. Draw and explain S-N curves for ferrous and non-ferrous metals. Explain different methods to improve fatigue resistance.

Module – 3

15. Draw the isothermal transformation diagram of eutectoid steel and then sketch and label one example of 1) time temperature path that will produce 100% pure coarse pearlite; 2) time temperature path that will produce 50% coarse pearlite and 50% fine pearlite; 3) time temperature path that will produce 75% martensite and 25% bainite; 4) time temperature path that will produce 100% martensite; 5) time temperature path that will produce bainite.

OR

16. Explain in detail the Iron Carbon equilibrium diagram with sketches of different microstructures. Distinguish between the properties of martensite, pearlite, ferrite and bainite with microstructures.

Module – 4

17. Explain the fundamental effects of alloying elements in steel on polymorphic transformation temperatures, grain growth, eutectoid point, retardation of the transformation rates, formation and stability of carbides.

OR

18. Compare the performance of cast iron for any four mechanical applications. How their microstructures influence the mechanical properties ? Explain.