Roll No……..….. **Total No. of Printed Pages: 1**
Total No. of Questions: [09]

B. Tech Mechanical Engineering (Semester 4th)
MATERIALS ENGINEERING
Subject Code: BMECS1-401
Paper ID: 18112315

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1. Attempt the following:

a. Define Fick's first law of diffusion.
b. What do you mean by critical cooling rate?
c. What is incubation period?
d. Enlist various defects which occurs due to heat treatment processes.
e. Define the term polymorphism and allotropy.
f. What is the effect of carbon on steel?
g. Enlist two applications of transmission electron microscopy.
h. What is lever rule in phase diagram?
i. Draw the packing pattern of HCP.
j. Differentiate steady state and non-steady state diffusion.

Section – B **(5 marks each)**

Q2. Discuss nitriding as a method of surface-hardening of steel and compare it with induction hardening.
Q3. Explain the theories of plastic deformation.
Q4. Discuss the effect of various alloying elements on properties of steel.
Q5. Calculate atomic packing fraction for FCC unit cell.
Q6. Explain the construction and working of scanning electron microscopy.

Section – C **(10 marks each)**

Q7. Draw and explain Iron-carbon (Fe-C) equilibrium diagram. Also highlight various reactions along with various phases.
Q8. Write a note on the properties and applications of followings

a) Piezoelectric materials
b) Nanomaterials

Q9. Discuss different types of imperfections in solids with the help of suitable diagrams