VIT
Vellore Institute of Technology

B1

SCHOOL OF MECHANICAL ENGINEERING

CONTINUOUS ASSESSMENT TEST – I - WINTER SEMESTER 2019-2020

Programme Name & Branch: B.Tech (Mechanical Engineering)

Course Name Code: MEE1005

Course Name: Materials Engineering and Technology

Faculty Name(s): Prof. SK Ariful Rahaman, Prof. Murugan R, Prof. Muthuchamy A, Prof. U Narendra Kumar

Class Number(s): VL201920500 - 1278 / 0810 / 2460 / 2597 **Exam Duration:** 90 mins **Max. Marks:** 50

General instruction(s): Answer all Questions

Section – A (5 x 2 = 10 Marks)

Sl.No.	Question	Course Outcome (CO)
1.	In most cases, poly-crystalline materials exhibit isotropic behavior. Why?	CO1
2.	It is known that the coordination number and atomic packing fraction is same as 12, 0.74 respectively for FCC and HCP crystal structures. Bring out any two reasons why FCC metals offer more ductility than HCP metals?	CO1
3.	"At ordinary temperatures, grain boundaries restrict the plastic flow by making it difficult for the movement of dislocation" – Whether the above statement is true or false. Justify your answer.	CO1
4.	At what instances, twin boundaries are formed?	CO1
5.	Mention any four details that can be possibly inferred from the microstructure study.	CO1

Section – B (4 x 10 = 40 Marks)

Sl.No.	Question	Course Outcome (CO)
6.	Calculate the number of vacancies per cubic meter in gold at 900 °C. The energy for vacancy formation is 0.98 eV/atom. Furthermore, the density and atomic weight for Au are 18.63 g/cm^3 (at 900°C) and 196.9 g/mol, respectively, and k = 8.62 x 10^{-5} eV/atom-K.	CO1
7.	For BCC the (110) plane contains two close-packed directions, Indicate these two directions and determine their labels using the [hkl] Miller-index notation. Also determine the area packing fraction characteristic of the (110) plane and quantitatively show that this plane is more densely packed than the (100) plane in BCC.	CO1
8.	The lower yield point for an iron that has an average grain diameter of 0.05 mm is 135 MPa. At a grain diameter of 0.008 mm, the yield point increases to 260 MPa. At what grain diameter will the lower yield point be 205 MPa?	CO1
9.	During solidification of Copper, a critical nucleus was formed which consisted of 696 atoms. Calculate the size of critical radius and the degree of undercooling given for homogeneous nucleation. Given: Latent heat of fusion = 1628 J/cm^3 Surface free energy = 177 × 10^{-7} J/cm^2 Lattice parameter = 0.3615 nm Melting point of copper = 1085 °C If the degree of undercooling is increases by 50 °C comment on the number of atoms joining to form the critical nucleus.	CO2