VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA
DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING
SESSION 2016 - 17 (ODD SEMESTER)

Total Pages—4

(Set-T_1)

B.Tech-3rd

Introduction to Physical Metallurgy

Full Marks : 70

Time : 3 hours

Answer **six** questions including
Q.No.1 which is compulsory

The figures in the right-hand margin indicate marks

Symbols carry usual meaning

1. Answer *all* questions : 2 × 10

(*a*) Mention any two differences between interstitial solid solutions and substitutional solid solutions.

(*b*) What is a phase ? What is the use of lever rule ?

(*c*) Mention any two differences between homogeneous and heterogeneous nucleation.

(*d*) Why are grain boundaries favorable sites for nucleation or growth of precipitates ?

(Turn Over)

(*e*) Draw and show the difference in the micro structures formed after annealing and normalizing.

(*f*) What is the difference between TTT and CCT?

(*g*) Mention differences between reconstructive and displacive transformations.

(*h*) Define recrystallization. What happens to strength of material during recrystallization?

(*i*) Write to advantages of cold working as compared to hot working.

(*j*) Draw a neat sketch of a cooling curve for pure metal.

2. (*a*) What are miller indices? How they are determined? 5

(*b*) Estimate the size of critical nucleus of tin when it is supercooled by 20°C. Assume nucleation to be homogeneous. The enthalpy change for solidification of tin is 0·42 GJ/m^3. the liquid/solid interfacial energy is 0·055 J/m^2. The melting point of tin is 232 °C. 5

3. (*a*) What is slip ? Mention four differences between slip and twinning. 5

(*b*) Mention five differences between hot working and cold working. 5

4. (*a*) Draw a neat sketch of iron carbon equilibrium diagram. Mentions all the phases, lines and temperatures. 5

(*b*) What are the effects of non-equilibrium cooling ? What is dendritic segregation ? 5

5. (*a*) What is tempering ? What are the micro-structural changes after tempering ? 5

(*b*) How do we correlate microstructure with mechanical properties of materials ? How these two are related ? Explain in brief by taking an example. 5

6. (*a*) Explain all the factors in detail which affects hardenability. 5

(*b*) Write notes on types of stainless steels and mention their applications. 5

7. (*a*) What is the effect of various alloying elements on TTT diagram ? Draw a TTT diagram for a eutectoid steel. 5

(*b*) What are the various factors that control the solubility in alloy systems ? 5

8. Write short notes on any *two* : 5 × 2

(*i*) Schmid factor

(*ii*) Hardenability

(*iii*) Phase rule and its importance

(*iv*) Physical metallurgy of copper alloys.
