

B. Met. Engg. 3rd Year 1st Sem. Supplementary Examination 2017

Subject: Physical Metallurgy II

Full Marks: 100

Time: 3 hours

Question no. 1 is compulsory. Answer any two (2) questions from the rest. Answers must be brief and to the point. All parts of the same question must be answered contiguously.

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| 1 | Answer any seven (7) questions. | 7x7 |
| | (a) Why is gray cast iron brittle? | |
| | (b) Differentiate: alloy, mixture and compound. | |
| | (c) What is coring? How is it possible to homogenise the cored structure? | |
| | (d) Derive the driving force for solidification. | |
| | (e) Why does constitutional super cooling occur in case of an alloy? | |
| | (f) Differentiate: recovery and recrystallization. | |
| | (g) What are the roles of temperature, strain and starting grain structure of the material on the recrystallisation kinetics? | |
| | (h) What is precipitate free zone? Why does it occur? | |
| 2 | (a) On what factors does the solid state heterogeneous nucleation rate depend? Substantiate. | 5 |
| | (b) Describe the different mechanisms of diffusion. What is Kirkendall effect? | 6+4 |
| | (c) Differentiate: uphill and downhill diffusion. Discuss the mechanism of Spinodal decomposition. | 5+5 |
| 3 | (a) Why do different microstructural regions form during ingot solidification? Derive the expression for the configurational entropy. Draw the free energy vs composition curves for a binary regular solution with ΔH_m positive, negative and zero. | 6+6+6 |
| | (b) Why does not peritectic reaction undergo completion? Why does ferrite has limited solid solubility of carbon? | 2+3 |
| 4 | (a) State: Fick's first and second law of diffusion. | 6 |
| | (b) What is nodular cast iron? What is melt treatment? Why does it have higher ductility than gray cast iron? | 3+4+3 |
| | (c) What is chemical potential? A binary A-B system has a eutectoid reaction at temperature T. (i) Draw the free energy vs composition curves for the three phases at temperature T. (ii) Draw the free energy vs composition curves at temperature slightly above T showing two phase equilibrium. | 3+3+3 |