



Answer 5 questions only

Q1 :- Recommend suitable temperatures for full annealing , normalizing , process annealing , spheroidizing annealing and hardening of : (a) 0.2%C (b) 0.77%C (c) 1.20%C steels . (10 marks)

Q2:- (a) What is age hardening treatment ? Discuss its importance in (1) Aluminum-copper alloys (2) Alnico alloys .

(b) What is meant by Temper designation T1, T5, T10 (10 marks)

Q3 :- Figure 1 shows how the hardness of a 1080 steel depends on time and temperature (a) Determine the activation energy for tempering by comparing the time-temperature combinations that result in a hardness of Rc 50 . (b) How many months (or years) could this steel be used at 200°C before its hardness falls to Rc 50? (10 marks)

Q4 :- (a) A steel has the chemical composition 0.08%C-2%Mn-11%Ni-20%Cr-0.02%V, determine the carbon equivalent and the preheat treatment if the plate thickness is 2.54 cm (b) What is meant by : Phase rule , Phase, Tempering martensite , austenitizing temperature, critical cooling rate . (10 marks)

Q5:- (a) Define tempering . What are main aims of tempering ? What is the driving force for tempering ? (b) Steel is made hard by quenching , List at least three requirements that must be met to justify this statement (c) Why are much higher austenitizing temperatures used for alloy steels than carbon steels for homogenization of them . (10 marks)

Q6 :- Discuss briefly: (a) Normalizing results in more uniform structure than annealing (b) Quench-crack tendency increase if carbon of the steel increase (c) Alloy steels are quenched-hardened in oil (d) A steel becomes softer on tempering (e) Age hardenable alloys are heated just above solvus temperature (f) Each steel has its own "TTT" diagram (f) Hardenability of steels (10 marks)

Figure 1

