B.E. MET. AND MAT. ENGG. THIRD YEAR SECOND SEMESTER EXAM 2018

SUBJECT: SOLID STATE PHASE TRANSFORMATION PROCESSES

Time: 3 hours **Full Marks: 100**

Answer any four (4) questions. Answers must be brief and to the point. All parts of the same question must be answered contiguously.

1	(a)	Why is step austenitising carried out during heat treatment of high speed steel?	6
	(b)	A specimen of 0.1 wt % of plain carbon steel was heated to 950 °C for 1 hour. Then the specimen was cooled in water. Do you expect to see quench crack? Justify.	6
	(c)	Is it possible to develop shape memory alloy using plain carbon steel? Explain.	7
	(d)	Why bainitic transformation is not possible during continuous cooling in plain carbon steel?	6
2	(a)	Why retained austenite is not desirable in high carbon tool steel?	5
	(b)	What are the differences in the TTT diagram for hypo and hyper eutectoid steels? Explain.	6
	(c)	Is bainitic transformation a eutectoid transformation? Justify.	7
	(d)	Do you think that presence of alloying elements in steel would increase the hardenability always? Justify.	7
3	(a)	Discuss the mechanism of bainitic transformation. Why is it called an intermediate transformation?	8+5
	(b)	Discuss the influence of deformation of austenite in martensitic transformation.	7
	(c)	Why is bainitic structure less responsive to tempering than martensitic structure?	5
4	(a)	What are the objectives of normalizing heat treatment? What is the typical normalizing temperature of hyper eutectoid steel? Why? Why does hardened and tempered steels find greater applications than bainitic steels?	4+1+3+5
	(b)	Discuss the role of carbon in matensitic transformation of steel. Why does martensitic structure exhibit high hardness even with small amount of carbon in steel?	6+6

5	(a)	How is it possible to obtain soft and tough martensite in steel? Give the chemical composition and the heat treatment schedule. What is the strengthening mechanism present in this steel?	8+5
	(b)	What is induction hardening? What are the advantages of induction hardening over chemical surface hardening treatments? Why is post nitriding heat treatment not required?	4+4+4
6	(a)	What is Hultgren extrapolation? What is the application of Hultgren extrapolation?	4+3
	(b)	Justify the selection of carburizing temperature. What is the depth of carburizing? How can you measure the depth of carburizing? Why does carburized part offer higher fatigue endurance?	6+3+3+6