Ref No Ex/Met / T / 324/2017 (old)

B.E. Metallurgical and Material Engineering Third Year Second Semester Exam 2017

Subject: Physical Metallurgy III

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

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.

1		**Answer any seven (7) questions.**	7x7
	(a)	Describe the process of Austenite formation during heating of a hypo eutectoid steel.	
	(b)	Why do carbide forming elements improve hardenability of steel?	
	(c)	Why does hardenability increase with increase in carbon content of the steel considering identical geometry of the specimens?	
	(d)	How do you carry out Jominy end quench test?	
	(e)	Define: critical diameter and ideal critical diameter	
	(f)	Write short note: temper embrittlement	
	(g)	Why does normalizing refine the microstructure of a steel?	
	(h)	What is the typical annealing temperature of hyper-eutectoid steel? Why?	
2	(a)	Describe the heat treatment schedule of high speed steel with microstructural changes that taking place in every stage. Why multiple tempering is recommended for high speed steel.	10+6
	(b)	Distinguish between normalising and annealing.	6
	(c)	Why does low carbon steel not require tempering after hardening?	3
3	(a)	Describe commercial carburising heat treatment of the steel. Justify the selection of carburising temperature.	10+5
	(b)	Why austenite is not present in pearlitic structure, but present in bainitic structure? What is critical cooling rate? What are the advantages of Jominy end quench test over Grossman hardenability test?	4+3+3

4	(a)	Why retained austenite is not allowed in heat treated tool steel? How retained austenite is eliminated from the as-quenched structure?	7
	(b)	"Hardenability of steel is not a fixed property" – Justify the statement.	6
	(c)	Why martensitic structure is very hard?	6
	(d)	Distinguish: upper bainite and lower bainite.	6