Ref. No.: Ex/Met/PC/B/T/322/2022

B.E. METALLURGICAL AND MATERIAL ENGINEERING
THIRD YEAR SECOND SEMESTER EXAM 2022

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	Why is nitriding imparted on the alloy steel? Why does hardness of the steel surface increase after nitriding? Why is post nitriding heat treatment not needed? How is hardened layer thickness determined during induction hardening?	7+7+ 4+7
2	How are the temperature and time of carburizing determined? How does the microstructure from the surface to the centre of the specimen after carburizing change? What is the heat treatment to improve the mechanical property of the carburized component? What is the need of multiple tempering after carburizing?	6+6+ 7+6+
3	What is the microstructure of high speed steel at room temperature? How is grain coarsening of high speed steel stopped and why? How is the amount of carbides in high speed steel controlled and why? What is the need of the subzero treatment in high speed steel heat treatment?	3+9+ 8+5
4	How does carbon content influence the hardness of martensite and pearlite in plain carbon steel? What is the effect of prior austenite grain size on the hardness of plain carbon steel? Why is carbon content nearly zero in maraging steel? What is the role of aging treatment in achieving the fracture toughness in maraging steel?	8+6+ 4+7
5	What is Hultgren extrapolation? What is the use of Hultgren extrapolation in designing the heat treatments of steel? What is the annealing temperature of hyper eutectoid steel? Justify. Is tempering imparted after annealing in hyper eutectoid steel? Substantiate.	6+6+ 7+6
6	Why is retained austenite available during Bainitic transformation? What are the reasons of excellent strength ductility of lower Bainitic microstructure? What is austempering? Can austempering be performed in plain carbon steel? Justify.	6+7+ 5+7