BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : III/ADD**
BRANCH: MECH/PROD **SESSION : MO/17**

SUBJECT: PE3001 METALLURGY

TIME: **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a)	How does a design engineer select his materials?	[2]
Q.1(b)	The shaft and blade of a screw driver is made of high carbon steel and handle is made of polymer or plastic. Justify the selection of such materials.	[4]
Q.1(c)	Name some of the recently developed metallic materials and their field of applications.	[6]
Q.2(a)	Describe briefly the principle of iron making and steel making.	[2]
Q.2(b)	An iron ore contains 63% Fe in it (i) % Fe_2O_3 and % Impurities in the ore. (ii) Amount of ore of this grade required for the production of 1-ton iron.	[4]
Q.2(c)	Describe in brief the principle of production of steel through double slagging method. Which process of steel making do you prefer and why?	[6]
Q.3(a)	What do you mean by allotropy? Draw the cooling curve of pure iron.	[2]
Q.3(b)	Draw an iron-carbon equilibrium diagram and explain the significance of various lines and regions enclosed by them.	[4]
Q.3(c)	For a 99.65 wt% Fe-0.35 wt% C alloy at a temperature just below the eutectoid, determine the following: (i) Fraction of total ferrite and cementite phases. (ii) Fraction of free ferrite and pearlite.	[6]
Q.4(a)	Define phase transformation. Discuss the factors affecting the phase transformation.	[2]
Q.4(b)	Sketch and explain TTT diagram for eutectoid and non-eutectoid steels. Define cooling rate.	[4]
Q.4(c)	How are the mechanical properties of steel controlled by hardening followed by suitable tempering?	[6]
Q.5(a)	Define Heat treatment of steel. What is the basic objective of heat treatment of steel?	[2]
Q.5(b)	Explain in brief the heat-treatment used to improve the machine ability of high carbon steel.	[4]
Q.5(c)	Define High speed steel. Explain briefly the effect of chemical constituents on the properties of high speed steel. What do you mean by secondary hardening effect in High speed steel.	[6]
Q.6(a)	Why S. G. iron is more machinable than Grey cast iron.	[2]
Q.6(b)	"Grey cast iron possess some unique properties which make it an useful engineering material. Mentioning those properties, state how those properties are derived.	[4]
Q.6(c)	For cathodic protection, a ship hull requires a current density of 15mA/m^2. Zinc is used as the sacrificial anode. What is the quantity of zinc required per m^2 of the hull surface foe protection to last 10 years? What will be the coating thickness of zinc? Given: Atomic wt of Zn = 65.37 Density of Zn = 7.133 gm/cm^3	[6]
Q.7	Write short notes on the following:- (i) Carburising and Nitriding (ii) Metallurgical aspect of welding (iii) German Silver and Duralumin.	[4x3]

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