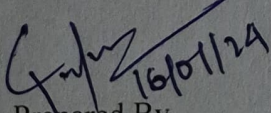


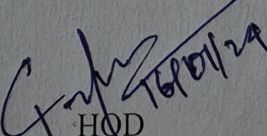
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Session: 2023-24

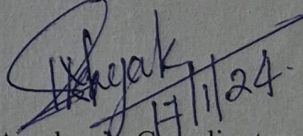
Discipline: Metallurgical Engineering	Semester: 4th	Name of the Teaching Faculty: Goutam Kumar Majhi	
Subject: (TH-03) SPONGE IRON AND FERRO ALLOYS	No. of days/per week class allotted: 4	Semester from Date: 16. 01. 2024 to Date: 26.04.2024 No. of weeks: 15	
Week	Class No.		Lecture Topics
1	1	Chapter -1: Review of Sponge Iron Making Processes	Historical Development. Reasons for Rapid growth of DR Process
	2		Chronological Evolutions of some of the DRI Processes
	3		Conventional versus DRI Steel Making
	4		Direct Reduction of Iron Ore
2	5	Chapter-2: Thermodynamics of Sponge Iron Making	Principles of Direct Reduction Reactions.
	6		Reaction between Coal, Oxygen and Carbon dioxide. (Set-I)
	7		Reaction between Iron ore and CO (Set-II)
	8		Reaction Mechanism in Coal based DRI
3	9		Reaction Mechanism in Gas based DRI.
	10		Reduction by Carbon monoxide
	11		Reduction by Hydrogen
	12		Boudourd reaction and Reduction by Carbon
4	13		Carbon Deposition
	14		Kinetics in DRI
	15		Factors Influencing the Reducibility of Iron Ore
	16		Rate Controlling Theories
5	17	Chapter-3: Major direct reduction processes	Coal based DR process using rotary kilns. SL/RN, CODIR, ACCAR, TDR, OSIL, Krupp-Rein processes.
	18		Coal based processes using reactors other than rotary kilns. Rotary hearth processes based on Inmetco, fastmet, It mk-3, Tunnel kiln processes kinglor-meter, hogans
	19		Gas based direct reduction HYL processes, MIDREX Fluidwise bed processes-FIOR-HIB
	20		Uses of DRI in iron making and steel making
6	21		Raw materials of Sponge Iron Making
	22		Chemical and Physical Tests on iron ore: Chemical composition, Reducibility,

7		Chapter-4: Parameters of of Sponge Iron Making	Strength, Tumbling, Abrasion and Shatter Index, Porosity, Bulk Density, Thermal Degradation Index (TDI)
	23		Tests on Non Coking Coal: Proximate and Ultimate Analysis, Reactivity, Calorific Value, Coking Index, Swelling Index, Ash Fusion Temperature, Bulk Density
	24		Effect of Iron Ore size on Reduction
	25		Carbon Enrichment of Sponge Iron
	26		How Carbon Enrichment of Sponge Iron is performed
	27		Flow of Solids in the Reactor or Kiln
	28		Process Parameters of Sponge Iron Production: Raw materials, Iron Ore Feed Rate, Coal Feed Rate, C/FeRatio, Dolomite Feed, Rate, Reduction Coal to Blow Coal Ratio , Ratio of coarse and Fines in Blow Coal, Blow Coal Pressure, Temperature Profile, Kiln Speed, Ore Retention Time and Cooler Discharge end Pressure
8	29	Chapter-5: DRI Plant Operation and Abnormalities	Nonmagnetic Percentage in the Kiln Discharge
	30		Daily Operating Parameters
	31		Operational Abnormalities: Process Pressure Fluctuations, Temperature Deviations, Back Spill, Loss of Process Fan(s), High Temperature of Cooler Discharge, Loss of Product Quality
	32		Major Problems of DRI Kiln Operation: Injection Coal Jam, Feed Pipe Jam, Transfer Chute Jam, Main Drive Problem, Refractory Failure their causes and remedies
9	33		Shutdown Procedure: Normal Shutdown Schedule for a 500 TDP Kiln
	34		The Start Up process: Heating of the Reactor Refractory
	35		Accretion Formation
	36		Key notes on process plant operation.
10	37	Chapter-6 :Quality Control in Sponge Iron Plant	Sampling: Sponge Iron and the Raw materials
	38		Chemical Analysis of Sponge Iron, Iron Ore, Lime Stone/Dolomite and Coal
	39		Scheme of Quality Control of input Raw Materials: Reactor Feed Iron Ore, Reactor Feed Coal, Back –Spill Coal, Slinger Coal
	40		Determination of Total Iron(FeT), Ferrous Iron and Metallic Fe

11	41	Chapter7:Environmental Management in DRI Plants	-do-
	42		Air Pollution Mitigation Measures
	43		Fugitive Dust Generation
	44		Water Pollution Mitigation Measures
12	45		Solid Waste Generation and Disposal
	46		Hazardous Wastes and Chemicals
	47		Occupational Health and Safety
	48		Environmental Monitoring
13	49		Environmental Standards
	50		-do-
	51		Introduction to Ferro-alloying elements
	52		Different Ferro alloys
14	53	Chapter-8 : Production of Ferro-alloys	General methods of producing Ferro alloys: carbothermic and aluminothermy reductions
	54		Refining of Ferro alloys
	55		Production of individual Ferro alloys: Ferro manganese, Ferro chrome, charge chrome, ferrosilicon Fe-Ti, Fe-W, Fe-Mo and Fe-V
	56		-do-
15	57		Revision Class
	58		Revision Class
	59		Revision Class
	60		Important question disussion


 Prepared By
 (G.K. Majhi, Lect. Metallurgy)


 HQD
 Metallurgical Engg.


 Academic-Coordinator