



# IRONMAKING AND STEELMAKING

## PROF. GOUR GOPAL ROY

Department of Metallurgical Engineering  
and Materials Sciences  
IIT Kharagpur

**PRE-REQUISITES** : Interested Learners

**INTENDED AUDIENCE** : Metallurgy, Mechanical, Chemical

**INDUSTRIES APPLICABLE TO** : HEC, Ranchi; Tata Steel, Jamshedpur; SAIL Steel plants; RINL steel Plant, JSW

### COURSE OUTLINE :

The emphasis on extractive metallurgy including ironmaking and steelmaking has been diluted significantly to accommodate newer courses on structure, properties and processing of different kinds of advanced materials. This is in contrary to the fact that India is going to be the second largest producer of crude steel in the world. Besides, after globalization of market, we stand in cut-through competition for day to day innovation in steel processing. Based on changing scenario a conceptual, fundamental and more quantitative course is desirable. Keeping in view of the above consideration, the course has been designed.

### ABOUT INSTRUCTOR :

Prof. Gour Gopal Roy is presently professor in the Department of Metallurgical & Materials Engineering at IIT Kharagpur and also joint faculty member of Steel Technology Center and Center of Excellence on Advanced Manufacturing Technology, IIT Kharagpur. Since the inception of his professional career at IIT Kharagpur in 1997, he is teaching the course Ironmaking and Steelmaking either as separate subject courses or in combined form.

### COURSE PLAN :

- Week 1:** Introduction: Various routes of modern steel making (BF-BOF, DRI-EAF, SR). Blast furnace Ironmaking: Shape of the furnace, Various reactions and zones in the blast Furnace Thermodynamics of Iron making, Direct & indirect reduction Blast Furnace as an efficient counter current gas solid reactor and maximum carbon efficiency.
- Week 2:** Overall heat and Material Balance in Blast Furnace. Rist Diagram based on oxygen balance Rist Diagram based on heat & Material balance
- Week 3:** Blast Furnace as a two stage reactor. Predictive model for coke rate in blast furnace.
- Week 4:** Aerodynamics in Blast Furnace (pressure drop, fluidization, channeling, Flooding).
- Week 5:** Burden preparation (sintering, pelletization, coke making). Testing of raw materials
- Week 6:** Burden distribution in Blast Furnace. Auxiliary injection, fuel efficiency and productivity in Blast furnace.
- Week 7:** Thermodynamics of steelmaking. Introduction to LD steel making (process, emulsion, decarburization, catch carbon technique, impurity & slag evolution)
- Week 8:** Hybrid steel making. Modern EAF/IF steel making. Secondary Steel making: Thermodynamics & kinetics of deoxidation
- Week 9:** Secondary steel making: Vacuum treatment of steel and processes, gas stirring.
- Week 10:** Secondary Steel making: Ladle desulphurization, inclusion modification by calcium treatment. Inclusion control by optimizing upstream operating parameters.
- Week 11:** Heat transfer and segregation during casting. Ingot casting, continuous casting, defects in steel.
- Week 12:** Alternative routes of iron & steel making (Rotary kiln, Corex, Midrex)