MONTANA TECH
Department of Metallurgical & Materials Engineering

EMET 420/520 – Physical Chemistry of Iron and Steelmaking

Instructor: Dr. A. Das
Office Hours: ELC 213, TR 8:00-9:00 and F 2.00-3.00 or by appointment, Spring Semester
Lecture: ELC 106; MWF 9:00-10:00
Prerequisites: EMAT 307 or Consent of Instructor
Co-Requisite: None
Designation: Elective in M&ME

2012-13 Catalog Description:
Physical chemistry principles are utilized to describe the unit operations in the production of iron and steel, including coke-making, sintering, iron-making, and steel-making. The course is offered on demand any semester.

Credits: 3 Credit-Hours (Lecture)

Lab: None.

Textbook: No Text Book.
Handouts, lecture notes and references will be provided as and when needed.

References: Larry G. Twidwell, Physical Chemistry of Iron and Steelmaking, a Modular Tutorial Course, 1990.
E. T. Turkdogan, Fundamentals of Steelmaking, Maney Publishing, 2010.
A. Ghosh and A. Chatterjee, Ironmaking and Steelmaking: Theory and Practice, Prentice Hall of India, 2008.

Relationship of Course to Metallurgical & Materials Engineering Program Outcomes:
The course is intended to impart the knowledge of ferrous extractive metallurgy. The relevant processes are dealt with in the light of the associated physical chemistry, thermodynamics and kinetics. The accessory processes such as coke making, sintering and steel casting are also touched upon. The course serves as the major course in M&ME for iron and steel production.

Objectives:
This course objective is to provide the students the exposure to the phenomena occurring in the production of iron and subsequently refining of iron to steel. The chemistry, thermodynamics, kinetics and engineering aspects of iron and steel production are covered. The students are provided with the information for controlling the reaction and thereby the production process more precisely.

Outcomes: Graduates of this course will or will be able to:
1) Describe the phenomena occurring in iron oxide reduction processes and the refining of iron to produce steel.
2) Describe how slags form, what their function is and how they may interact with metal & refractories.
3) Describe the importance of phase equilibria in iron and steelmaking unit operations.

Topics:
1. Physical chemistry of iron ore reduction
2. Physical chemistry of iron and steel production
3. Physical chemistry of slags and refractories
4. Blast furnace iron making

5. Directly reduced iron
6. Basic oxygen steelmaking
7. EAF steelmaking
8. Secondary steelmaking
9. Agglomeration
10. Steel casting

Attendance Policy: Roll is taken periodically and may not count towards final grade normally. However, marked absence will evoke new policy and may adversely affect the final grade.

Grading Policy: There will be some homework assignments. The course will have one final examination. In addition, the students signed up for graduate level (EMET 520) will have to do a term paper/presentation. The final grades will be decided based on the performances on all of these.

Plagiarism: Zero tolerance on plagiarism of all forms.

Professional Component:
Engineering Topics – 100%
Engineering Design – No
Computer Usage – spreadsheets
Ethics – Yes
Statistics – Yes
Safety – Yes

ABET Outcomes Covered: 1, 4, 7, 9, and 10

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
7. acquire and apply new knowledge as needed, using appropriate learning strategies
9. integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing and performance related to metallurgical and materials systems appropriate to the field, and
10. apply and integrate knowledge from each of the above four elements of the field using experimental, computational and statistical methods to solve materials problems including selection and design consistent with the program educational objectives.

Prepared by: Avimanyu Das **Date:** November 12, 2018