

MME 4303 Metals Processing (Fall 2020, CRN 11329)

Instructor: Guikuan Yue, Ph.D., gyue@utep.edu, 747-6934

Office Hours: M201-D Tuesday (13:30-15:00 PM) and Thursday (9:30–10:30 AM) or by appointment (Virtually via Blackboard Collaborate)

Class Days: Tuesday and Thursday, 12:00-13:20, On-Line (Blackboard)

References:

1. Peter C. Hayes. Process Principles in Minerals and Materials Production, Third Edition. Hayes Publishing Co., Australia, 2003. ISBN-10: 0958919739
2. Mark E. Schlesinger, Matthew J. King, Kathryn C. Sole and William G. Davenport. Extractive Metallurgy of Copper, Fifth Edition. Amsterdam: Elsevier Ltd., 2011. ISBN: 978-0-08-096789-9
3. Terkel Rosenqvist. Principles of Extractive Metallurgy, 2nd Revised edition. Tapir Academic Press, 2004. ISBN-10: 8251919223

Prerequisites: MME 3306, MME3308, each with a grade of "C" or better.

Course description: Analysis of the unit operations involved in metal and mineral production using the principles of material and energy balance, fluid flow, heat transfer, reaction kinetics, and thermodynamics. A chemistry review of the fundamentals specifically involved in pyrometallurgy and hydrometallurgy will be included. Survey of processing operations for specific metals such as copper, iron, aluminum, etc.

Course objective: At the end of this course, students will have a solid grasp of fundamentals in the principles of pyrometallurgy and hydrometallurgy, as well as of the flow sheet of industrial metals production (copper, iron and aluminium), and can apply them to analyze and address the practical problems of most of the metals' production.

Topics: Units and unit analysis; stoichiometry; conservation of mass; mass balances; First law of thermodynamics; energy balances for closed systems; specific heat, sensible heat and enthalpy increments; heats of formation and reaction; adiabatic flame temperature; fuels and combustion; liquid, solid and gaseous fuels; combustion stoichiometry, excess air; heating values; gas reforming and substoichiometric combustion; reactors for pyrometallurgical unit processes; fixed and fluidized beds; shaft furnaces; rotary kilns; reverberatory furnaces; electric furnaces; pneumatic reactors; balance reactions; stoichiometric calculation; solution chemistry; equilibrium constant; introduction to leaching; mineral processing; copper production by pyrometallurgy and hydrometallurgy; iron production by blast furnace; aluminium production by Bayer process and Hall-Heroult process.

Grading	Percent
Assignments	20%
Midterm Exam	25%
Group Project	25%
Final Exam	30%

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LECTURE OUTLINE

Introduction

Extractive metallurgy; Pyrometallurgy; Hydrometallurgy; Electrometallurgy;
Unit operations and Unit processes; Process flow sheets.

1. Chemistry Review

1.1 Pyrometallurgy: Mass Balance, Heat Balance, etc.

1.2 Hydrometallurgy: Balance Reactions, Equilibrium, Kinetics, etc.

2. Introduction to Mineral Processing

2.1 Mineralogy

2.2 Size Reduction

2.3 Particle (mineral) Selection

2.4 Screening.

3. Introduction to Extractive Metallurgy

3.1 Pyrometallurgy

3.2 Hydrometallurgy

3.3 Electrometallurgy

4. Case Studies

4.1 Copper Production by Pyrometallurgy

4.2 Copper Production by Hydrometallurgy

4.3 Iron Production by Blast Furnace and Direct-Reduction

4.4 Aluminium Production by Bayer Process and Hall-Heroult Process

Course Withdrawal Policy: If a student withdraws from a course prior to the official census date of any semester, the course will be deleted from the student's record. Withdrawal from a course initiated by a student after the census date but prior to the course drop deadline, will result in a grade of "W." After the course drop deadline, withdrawal from a course initiated by a student will result in a grade of "F."

Attendance: University policy dictates that all students attend all scheduled classes, meaning that attendance to both the class and laboratory sessions is mandatory. However, I understand if you have conferences or other school-related activities to attend. Please notify me of any commitments you may have prior to you being absent from class. "Emergency" absences will be handled on a case by case basis

According to UTEP Curriculum and Classroom Policies, "When, in the judgment of the instructor, a student has been absent to such a degree as to impair his or her status relative to credit for the course, the instructor may drop the student from the class with a grade of "W" before the course drop deadline and with a grade of "F" after the course drop deadline." See academic regulations in the UTEP Undergraduate Catalog for a list of excuse absences. Therefore, if I find that, due to non-performance in the course, you are at risk of failing, I will drop you from the course. I will provide 24 hours advance notice via email.

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OR

I will not drop you from the course. However, if you feel that you are unable to complete the course successfully, please let me know and then contact the [Registrar's Office](#) to initiate the drop process. If you do not, you are at risk of receiving an "F" for the course.

Homework: Homework assignments will normally be due two weeks after they are assigned. No late homework will be accepted.

E-Mail Policy: Please do not send e-mails regarding the course to me with an account other than your UTEP account. Do not turn in homework assignments via e-mail unless directly instructed to do so.

Use of Electronic Devices: As a courtesy to me and the other students in class, the use of cell phones, and pagers is not allowed while class is in session.

Cheating, Plagiarism, Scholastic Dishonesty, and Student Discipline:

Students who engage in scholastic dishonesty will be subject to disciplinary action as stated in the UTEP-HoOP:

"Scholastic dishonesty (which includes the attempt of any student to present the work of another as his or her own, or any work which s(he) has not honestly performed, or attempting to pass any examination by improper means) is a serious offense and will subject the student to disciplinary action. The aiding and abetting of a student in any dishonesty is held to be an equally serious offense. All alleged acts of scholastic dishonesty should be reported to the Dean of Students for disposition. It is the Dean of Students' responsibility to investigate each allegation, dismiss the allegation, or proceed with disciplinary action in a manner which provides the accused student his or her rights of due process."

See the Dean of Students office for further information at website

<http://sa.utep.edu/studentlife/>; judicial affairs process at

<http://sa.utep.edu/studentlife/files/2010/10/Appendix-A-Discipline-process-NEW-OSL-2009.pdf>

Cite, reference, or quote information obtained from other sources and give credit where credit is due. In addition, when it is specified that a task needs to be performed individually, soliciting your classmates' help is considered scholastic dishonesty. Do NOT copy any material regardless of where you obtained it into your own work. Do NOT submit work under your name if you did not complete it entirely yourself; you may **not submit work you completed for another class**, unless specifically stated otherwise. In accordance with university policy, any instances of plagiarism and dishonesty will be reported to the Dean of Students Office. If you are caught cheating you will be subject to the disciplinary action defined by UTEP's Standards of Conduct and Dishonesty

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including the receiving of an incomplete “I” for the class and adjudication by the Dean of Students.

Disabilities: UTEP seeks to provide reasonable accommodations for all qualified individuals with disabilities, including learning disabilities. This university will adhere to all applicable federal, state, and local laws, regulations and guidelines with respect to providing reasonable accommodations as required affording equal educational opportunity.

If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at (915) 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

It is the student's responsibility to register with The Center for Accommodations and Support Services and arrange the appropriate accommodations.

Participation: All classes will be delivered online during scheduled times with your professor and other students. Please note required meeting days and times for this class. Attendance is determined by class participation online. You are required to come to class and be on time.

Your participation in the course is important not only for your learning and success but also to create a community of learners. Participation is determined by completion of the following activities:

- o Reading/Viewing all course materials to ensure understanding of assignment requirements
- o Participating in engaging discussion with your peers on the discussion boards
- o Participating in scheduled Blackboard Collaborate sessions
- o Other activities as indicated in the weekly modules

Because these activities are designed to contribute to your learning each week, they cannot be made up after their due date has passed.

Technology Requirement: Course content is delivered via the Internet through the Blackboard learning management system (LMS). Ensure your UTEP e-mail account is working and that you have access to the Web and a stable web browser. Mozilla Firefox and Google Chrome are the most supported browsers for Blackboard; other browsers may cause complications with the LMS. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

You will need to have access to a computer/laptop, scanner, a webcam, and a microphone. You will need to download or update the following software: Microsoft Office, Adobe Acrobat Reader, Windows Media Player, QuickTime, and Java. Check that

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your computer hardware and software are up-to-date and able to access all parts of the course.

If you do not have a word-processing software, you can download Word and other Microsoft Office programs (including Excel, PowerPoint, Outlook and more) for free via UTEP's Microsoft Office Portal. Click the following link for more information about [Microsoft Office 365](#) and follow the instructions.

IMPORTANT: If you encounter technical difficulties beyond your scope of troubleshooting, please contact the UTEP [Help Desk](#) as they are trained specifically in assisting with technological needs of students. Please do not contact me for this type of assistance. The Help Desk is much better equipped than I am to assist you!

Course Communication: How we will stay in contact with each other

Because this is an online class, we won't see each other in the ways you may be accustomed to: during class time, small group meetings, and office hours. However, there are a number of ways we can keep the communication channels open:

- Office Hours: We will not be able to meet on campus, but I will still have office hours for your questions and comments about the course. My office hours will be held on Blackboard Collaborate using regular online classroom and during the following times: Tuesday (13:30-15:00 PM) and Thursday (9:30–10:30 AM) (Virtually via Blackboard Collaborate), MST
- Email: UTEP e-mail is the best way to contact me. I will make every attempt to respond to your e-mail within 24-48 hours of receipt. When e-mailing me, be sure to email from your UTEP student account and please put the course number in the subject line. In the body of your e-mail, clearly state your question. At the end of your e-mail, be sure to put your first and last name, and your university identification number.
- Discussion Group: If you have a question that you believe other students may also have, we can meet all together during office hours.
- Announcements: Check the Blackboard announcements frequently for any updates, deadlines, or other important messages. I will also send by emails.

Netiquette: As we know, sometimes communication online can be challenging. It's possible to miscommunicate what we mean or to misunderstand what our classmates mean given the lack of body language and immediate feedback. Therefore, please keep these netiquette (network etiquette) guidelines in mind. Failure to observe them may result in disciplinary action.

o Always consider audience. This is a college-level course; therefore, all communication should reflect polite consideration of other's ideas.

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- o Respect and courtesy must be provided to classmates and to the instructor at all times. No harassment or inappropriate postings will be tolerated.
- o When reacting to someone else's message, address the ideas, not the person. Post only what anyone would comfortably state in a face-to-face situation.
- o Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only. Please do not copy documents and paste them to a publicly accessible website, blog, or other space.

Blackboard Collaborate Sessions: This class requires that you participate in scheduled Blackboard Collaborate sessions. The purposes of these sessions are for you to view live demonstrations of the course material and/or to participate in small discussion groups with your classmates.

The sessions will be recorded and provided so that they can be reviewed by classmates at a later time. Students should not record the sessions and post them to any sites outside of Blackboard.

Alternative Means of Submitting Work in case of Technical Issues: I strongly suggest that you submit your work with plenty of time to spare in the event that you have a technical issue with the course website, network, and/or your computer. I also suggest you save all your work (answers to discussion points, quizzes, exams, and essays) in a separate Word document as a back-up. This way, you will have evidence that you completed the work and will not lose credit. If you are experiencing difficulties submitting your work through the course website, please contact the UTEP Help Desk. You can email me your back-up document as a last resort.

Incomplete Grade Policy: Incomplete grades may be requested only in exceptional circumstances after you have completed at least half of the course requirements. Talk to me immediately if you believe an incomplete is warranted. If granted, we will establish a contract of work to be completed with deadlines.

COVID-19 Accommodations: Students are not permitted on campus when they have a positive COVID-19 test, exposure or symptoms. If you are not permitted on campus, you should contact me as soon as possible so we can arrange necessary and appropriate accommodations.

Scholastic Integrity: Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or

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knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the [Office of Student Conduct and Conflict Resolution \(OSCCR\)](#) for possible disciplinary action. To learn more, please visit [HOOP: Student Conduct and Discipline](#).

Class Recording: The use of recordings will enable you to have access to class lectures, group discussions, and so on in the event you miss a synchronous or in-person class meeting due to illness or other extenuating circumstance. Our use of such technology is governed by the Federal Educational Rights and Privacy Act (FERPA) and UTEP's acceptable-use policy. A recording of class sessions will be kept and stored by UTEP, in accordance with FERPA and UTEP policies. Your instructor will not share the recordings of your class activities outside of course participants, which include your fellow students, teaching assistants, or graduate assistants, and any guest faculty or community-based learning partners with whom we may engage during a class session. **You may not share recordings outside of this course.** Doing so may result in disciplinary action.

Copyright Statement for Course Materials: All materials used in this course are protected by copyright law. The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course. They may not be further disseminated.

COVID-19 Precautions: You must STAY AT HOME and REPORT if you (1) have been diagnosed with COVID-19, (2) are experiencing COVID-19 symptoms, or (3) have had recent contact with a person who has received a positive coronavirus test. Reports should be made at screening.utep.edu. If you know of anyone who should report any of these three criteria, you should encourage them to report. If the individual cannot report, you can report on their behalf by sending an email to COVIDaction@utep.edu.

For each day that you attend campus—for any reason—you must complete the questions on the UTEP screening website (screening.utep.edu) prior to arriving on campus. The website will verify if you are permitted to come to campus. Under no circumstances should anyone come to class when feeling ill or exhibiting any of the known COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, and alternative instruction will be provided. Students are advised to minimize the number of encounters with others to avoid infection.

Wear face coverings when in common areas of campus or when others are present. You must wear a face covering over your nose and mouth at all times in this class. If you choose not to wear a face covering, you may not enter the classroom. If you remove your face covering, you will be asked to put it on or leave the classroom. Students who refuse to wear a face covering and follow preventive COVID-19 guidelines will be

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dismissed from the class and will be subject to disciplinary action according to Section 1.2.3 *Health and Safety* and Section 1.2.2.5 *Disruptions* in the UTEP Handbook of Operating Procedures.

(classes with on-campus meetings) Please note that if COVID-19 conditions deteriorate in the City of El Paso, all course and lab activities may be transitioned to remote delivery.

Course Resources: Where you can go for assistance

UTEP provides a variety of student services and support:

Technology Resources

- **Help Desk:** Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.

Academic Resources

- **UTEP Library:** Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- **University Writing Center (UWC):** Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- **Math Tutoring Center (MaRCS):** Ask a tutor for help and explore other available math resources.
- **History Tutoring Center (HTC):** Receive assistance with writing history papers, get help from a tutor and explore other history resources.
- **RefWorks:** A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.

Individual Resources

- **Military Student Success Center:** Assists personnel in any branch of service to reach their educational goals.
- **Center for Accommodations and Support Services:** Assists students with ADA-related accommodations for coursework, housing, and internships.
- **Counseling and Psychological Services:** Provides a variety of counseling services including individual, couples, and group sessions as well as career and disability assessments.