

# Syllabus

## MME 4342: Hydrometallurgy

**Instructor:** Wayne Campbell, Ph.D.

- **Office Hours:** Mon 9:00 am–10:00 am or as arranged by e-mail:  
**wacampbell2@miners.utep.edu**

**Class Schedule:** Tuesday/Thursday 4:30pm-5:50pm in Room M302.

### References:

1. **Extractive Metallurgy: Processes and Applications**, Sujay Kumar Dutta, Avinash B. Lele, and Yakshil B. Chokshi, PHI Learning Pvt. Ltd. (2018)
2. Mark E. Schlesinger, Matthew J. King, Kathryn C. Sole and William G. Davenport.
  - a. **Extractive Metallurgy of Copper**, Fifth Edition. Amsterdam: Elsevier Ltd., 2011. ISBN: 978-0-08-096789-9
  - b. 978-0-08-096789-9
3. Michael L. Free. **Hydrometallurgy: Fundamentals and Applications**. John Wiley & Sons, Inc., Hoboken, New Jersey, 2013. Print ISBN: 9781118230770 | Online ISBN: 9781118732465
4. Peter C. Hayes. **Process Principles in Minerals and Materials Production**, Third Edition. Hayes Publishing Co., Australia, 2003. ISBN-10: 0958919739

**Prerequisites:** MME 4303 w/C or better

**Course Description:** Hydrometallurgy: The study of metal extraction process in aqueous solutions from ore or concentrates.

**Course Objectives:** At the end of this course, students will have a solid grasp of fundamentals in the principles of hydrometallurgical extraction of metals, as well as of the unit operations of industrial metals production, and can apply them to analyze and address the practical problems of most of the metals' production by hydrometallurgy.

### Topics to Cover:

- Introduction to Hydrometallurgy
- Froth Flotation
- Leaching Theory
- Solvent Extraction
- Electrowinning and Electrorefining
- ER Slimes Processing
- Case Studies

<u>Grading</u>	<u>Percent</u>
Assignments	30%
Quizzes	20%
3 Tests	30%
Final Exam	20%

## **Class Schedule (Subject to Change!)**

### **Week 1:**

August 27: Lecture on Introductions

August 29<sup>th</sup>: Lecture on De Re Metallica

### **Week 2:**

September 3: Lecture on Introduction to Chemistry and Water

September 5<sup>th</sup>: **Quiz #1 (on first 3 lectures)** & Lecture on Thermodynamics Part 1

### **Week 3:**

September 10<sup>th</sup>: Lecture on Thermodynamics Part 2

September 12<sup>th</sup>: Lecture on Froth Flotation Part 1

### **Week 4:**

September 17<sup>th</sup>: Lecture on Froth Flotation Part 2

September 19<sup>th</sup>: **Quiz #2 (on Thermo Lectures, and Froth Flotation)** & Lecture on Froth Flotation Part 3.

### **Week 5:**

September 24<sup>th</sup>: Lecture on Leaching Part 1 & Review for Test #1

September 26<sup>th</sup>: **TEST #1 (on Introduction, De Re Metallica, Thermo Lectures, and Froth Flotation).**

### **Week 6:**

October 1<sup>st</sup>: Lecture on Leaching Part 2

October 3<sup>rd</sup>: Lecture on Bioleaching

### **Week 7:**

October 8<sup>th</sup>: **Quiz #3 (on Leaching/Bioleaching)** & Lecture on Practical Leach Problems

October 10<sup>th</sup>: Lecture on Solvent Extraction Part 1

### **Week 8:**

October 15<sup>th</sup>: Lecture on Solvent Extraction Part 2

October 17<sup>th</sup>: **Quiz #4 (on Solvent Extraction)** & Lecture on Case Study #1

**Week 9:**

October 22<sup>nd</sup>: Review for Test #2

October 24<sup>th</sup>: **TEST #2 (on Leaching, Bioleaching, Solvent Extraction).**

**Week 10:**

October 29<sup>th</sup>: Lecture on Electrowinning and ER Part 1

October 31<sup>st</sup>: Lecture on Electrowinning and ER Part 2

**Week 11:**

November 5<sup>th</sup>: Lecture on Electrowinning and ER Part 3

November 7<sup>th</sup>: **Quiz #5 (on Electrometallurgy)** & Lecture on Slimes Part 1

**Week 12:**

November 12: Lecture on Slimes Part 2

November 14<sup>th</sup>: Lecture on Case Study #2

**Week 13:**

November 19: Lecture on Special Topics and Review Test #3

November 21<sup>st</sup>: **TEST #3 (on Electrowinning, Electrorefining, Slimes).**

**Week 14:**

November 26<sup>th</sup>: No Class Meeting

November 28<sup>th</sup>: Thanksgiving

**Week 15:**

December 3<sup>rd</sup>: Case Study #3 and Review for Final

December 5<sup>th</sup>: Review for Final

**Week 16:**

Finals Week, Final Date TBD

**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.

**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. Late homework will incur a penalty of -10 points per day.

**E-Mail Policy:** Please do not send e-mails regarding the course to me with an account other than your UTEP account.

**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 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](mailto: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](http://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.

**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 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!

**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.

- 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:** You may 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.

**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 knowingly represents the words or ideas of another as one's 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 discussions or reviewing course materials, 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.