MONTANA TECH

Metallurgical & Materials Engineering Department

EMAT 402 – ELEVATED TEMPERATURE PROCESS SYSTEMS

Syllabus

Instructor: Dr. Jerry Downey (ELC 215; 496-4578) **Office hours:** as posted

Course Description: Basic engineering principles are used to explain the production of metals from ores by high temperature processes. Topics include drying, calcining, roasting, sintering, agglomeration, smelting, converting, and refining. Applications to lime and cement manufacturing are covered. Waste production, waste treatment, and environmental controls are illustrated and discussed.

Credits and Class Meetings: 3 lecture credit hours. Class meets from <times> on <days> in <enter Building and Room Number>.

Designation: required for the B.Sc. degree in Metallurgical and Materials Engineering.

Prerequisites: EMAT 307 or Consent of Instructor

Textbook and References: No textbook. Selected reading from supplemental literature may be assigned in class and/or posted on Moodle. Students may find the following references to be valuable resources:

Pyrometallurgy, A modular, tutorial course designed for self-paced learning, L.G. Twidwell, sponsored by the National Science Foundation, circa 1980.

Chemical Metallurgy, J.J. Moore, Butterworth & Co., 1981 (ISBN 0-408-00430-4)

Principles of Extractive Metallurgy, Rosenqvist, McGraw-Hill, 1974 (ISBN 0-07-053847-6)

Nonferrous Extractive Metallurgy, Gill, John Wiley & Sons, 1980 (ISBN 0-471-05980-3)

Course Relationship to M&ME Program Outcomes: EMAT 402 examines the application of thermal processing technologies in metallurgical and materials engineering. The focus is the chemical and thermodynamic basis for selected high temperature unit operations. Current industrial operations are studied, including both large scale extractive operations and smaller-scale materials synthesis and coating processes. The subject matter also includes the design aspects of commercial environmental control technologies and the application of conventional metallurgical technologies to waste treatment and recycling.

Topics – the planned lecture topics include but are not limited to:

1. Course introduction and overview
2. Flowsheets and material balances
3. Thermodynamics review and heat balances
4. Drying and calcination
5. Roasting and sintering
6. Slags, molten salts, and refractories
7. Ferrous metal smelting and refining
8. Nonferrous metal smelting and refining
9. Environmental control technologies
10. Material synthesis

Objectives and Outcome: the course is designed to acquaint students with the theory, design, and applications of thermal processes that are common to the practice of Metallurgical and Materials Engineering. Course graduates will have demonstrated their proficiency in:

1. Calculating mass and heat balances for industrial applications
2. Applying thermodynamic principles to solve thermal processing problems
3. Selecting and sizing process equipment

The objectives and outcome are responsive to the following ABET Criteria for skills, knowledge, and behaviors:

(1) Identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematic

(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.

Evaluation and Grading Criteria: grades are determined as follows:

Homework & Quizzes:	40% (or 0.4 x weighted average of homework and quiz scores)
50-min. Examinations:	40% (or 0.4 x examination average)
Notebook:	5% (or 0.05 x notebook score)
Final Examination:	15% (or 0.15 x examination score)

where

A = 90 to 100
B = 80 to <90
C = 70 to <80
D = 60 to <70
F = <60 + or – grades may be assigned at the instructor's discretion

Each student receives feedback on his or her current class standing when the graded examinations are returned. The feedback includes the student's exam score, the class average for the exam, the student's point total, the class average point total, and the student's current rank in the class.

Attendance: class attendance will be recorded but it is not a factor in the assessment and grading criteria. However, students are responsible for all material covered in class, whether or not they choose to attend. Students should arrange to obtain class notes from another student. Do not ask to borrow the instructor's lecture notes or grading keys.

Students must submit their assignments in advance of field trips, athletics, or other school-sanctioned events that force them to miss class. The student is responsible for notifying the instructor, submitting homework assignments, and sitting for examinations prior to the absence.

Examinations: Students are required to sit for three 75-minute examinations. The examinations are each graded on a 100-point maximum basis. Unless otherwise specified by the instructor, the examinations are closed book and closed notes. In general, the examinations emphasize the subject matter presented in class and the reading assignments for the period subsequent to the preceding exam.

The 75-minute examinations are tentatively scheduled for the last weeks of September, October, and November. The instructor reserves the right to alter the examination schedule by providing at least one week advance notice to the class. The final is a comprehensive, 2-hour examination, and it is graded on a 100-point basis. The final examination will be held at the date and time scheduled by the Registrar's Office at the start of each semester.

It is the student's responsibility to sit for the examinations at the scheduled dates and times. As a general rule, make-up examinations are not given for unexcused absences. Exceptions are decided on a case-by-case basis for unavoidable absences resulting from sudden illness or other extreme emergencies.

Each student receives feedback on his or her current class standing when graded examinations are returned. The feedback includes the student's exam score, the class average for the exam, the student's point total, the class average point total, and the student's current rank in the class.

Homework: Reading, design, and problem-solving assignments, are distributed in class and/or posted on Blackboard. The course includes approximately 10-12 homework assignments, and each assignment is graded on a 100-point basis. The homework cover sheets (posted on Blackboard and/or distributed in class) specify the due date. Homework must be submitted prior to the start of class on the due date. Late work is not accepted and receives the grade of zero.

Students are encouraged to work in groups, but each is personally responsible for completing and submitting the assignments. In order to receive full or partial credit, problem solutions that involve computations and/or derivations must show all steps, state assumptions, express the answers using proper engineering units, and clearly indicate the final answer. Homework is expected to be neat and well-organized with correct spelling and grammar. Illegible or incomplete work is returned with a score of zero.

Quizzes: generally intended to reinforce the learning process, quizzes may be given with or without (i.e. a "pop quiz") advance notice. Subject matter covered during the previous and present lecture and/or the associated readings is considered fair game. The pop quiz frequency correlates directly to the occurrence of classroom disruptions during lecture. Potential disruptions include but are not necessarily limited to: late arrivals or early departures by students, extraneous conversations, cell phone usage, text messaging, etc. Each quiz question is graded on a 100-point basis and there is no limit to the number of quizzes that may be given during the semester. Make-up quizzes are not given in instances of unexcused absence.

Notebook: Students are expected to organize their lecture notes, supplemental reading and reference materials, graded homework and examinations, and other course materials in a three-ring binder. Students are required to submit their notebooks for grading during class on the date of the 3rd 70-minute examination. Graded notebooks will be returned prior to finals week.

Absence: Montana Tech policy dictates that "faculty should make reasonable accommodation for students to make-up work missed (or the equivalent) because of an excused absence. Excused absences include official Montana Tech events or activities, or personal matters deemed appropriate by the instructor." Official Montana Tech Events or activities include:

- NAIA sanctioned sporting events
- Academic Team competitions
- Travel for professional meetings related to major
- Class field trips
- Others as approved by the Chancellor

Students must submit their assignments in advance of field trips, athletics, or other school-sanctioned events that cause them to miss class the day that the assignment is due. The student is responsible for notifying the instructor and submitting homework assignments prior to the absence. Following an absence, students should arrange to obtain class notes from another student. Under no circumstances will students be granted access to the instructor's lecture notes or grading keys.

It is the student's responsibility to sit for the examinations at the scheduled dates and times. If a student misses one of the scheduled 75-minute examinations for any reason, the sole recourse is make arrangements with the instructor to sit for a make-up exam. The instructor must receive the written request for the make-up examination at least one week prior to the make-up examination date. The make-up examinations will be scheduled to take place on a mutually convenient date, time, and place prior to finals week. Students are cautioned to arrive early as those who arrive after the designated starting time will not be allowed to take the examination. Each student is allowed one (1) make-up examination due to absence. An examination missed without make-up is assigned the grade of zero (0).

Academic Integrity: Students enrolled in the Metallurgical and Materials Engineering courses are expected to maintain an integrity standard that is consistent with the applicable fundamental canons of the NSPE Code of Ethics for Engineers. Specifically, students are expected to conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

Academic dishonesty or cheating will not be tolerated. Students are expected to adhere to the Montana Tech Academic Honesty policy (see Addendum 1 and/or the Montana Tech student handbook).

If it is determined that a student has deliberately cheated on a report, quiz, or examination, the student will be dropped from the course with an "F" grade. In compliance with Montana Tech policy, all cases of academic dishonesty will be reported to the Office of the Vice Chancellor for Academic Affairs.

With one exception, the Department policy is that electronic devices are not to be activated or evident during lectures, quizzes, and examinations. This restriction includes but is not limited to programmable calculators, cell phones, laptop computers, mp3 players, dvd players, and all types of recording devices. The exception is that students are permitted to use a nonprogrammable calculator during lectures, quizzes, and exams. Students that possess unapproved calculators or other electronic devices during a quiz or exam are subject to dismissal from the classroom.

No student is allowed to record, tape, or photograph any classroom or laboratory activity without the express written consent of the instructor.

Disability Accommodations: Students that require academic accommodation because of disabilities must:

1. Register with and provide documentation to the Montana Tech Student Disability Coordinator
2. Provide the instructor with a letter that states the need and type of accommodation. This should be done during the first week of class.

Professional Component:

Engineering Topics:	100%
Design Component:	Yes (Mass & energy balances; equipment selection and sizing)
Computer Usage:	Yes (Excel spreadsheets; thermodynamic process models)
Ethics:	Yes (Sustainability; personal & professional ethics stressed)
Statistics:	No
Safety:	Yes (Relevant safety aspects discussed in selected lectures)

Prepared by: J. Downey
Finalized: <date, each semester>

ADDENDUM 1: Montana Tech Academic Honesty Policy

Montana Tech believes that academic honesty and integrity are fundamental to higher education. Montana Tech has a responsibility to promote academic honesty, integrity, and the highest ethical and professional standards and behavior in and out of the classroom. Accordingly, policies and procedures have been developed to address instances of academic dishonesty. Students who violate these standards commit academic misconduct and will be subject to academic and/or disciplinary sanctions.

Academic Dishonesty

Academic dishonesty includes cheating; plagiarism; forgery; falsification; facilitation or aiding academic dishonesty; multiple submission; theft of instructional materials or tests; access to, manipulation of, or tampering with laboratory equipment, experiments, or computer programs without proper authorization; alteration of grades or files; misuse of research data in reporting results; use of personal relationships to gain grades or favors; and any actions intended to gain academic advantage by fraudulent and/or deceptive means.

Student Responsibility

The student has full responsibility for the content and integrity of all academic work submitted. Ignorance of a rule does not constitute a basis for waiving the rule or the consequences of that rule. Students unclear about a specific situation should ask their instructors or academic staff, who will explain what is and is not acceptable in their classes or on campus.

Faculty, Staff, and Administrator Responsibility

It is the shared responsibility of faculty, staff, and administrators to take reasonable precautions to prevent and discourage academic dishonesty. Additionally, it is a duty of faculty, staff, and administrators to report instances and charges of academic dishonesty to the Office of the Vice Chancellor for Academic Affairs through the Academic Dishonesty Violation online referral form.

Cheating

Cheating is defined as obtaining or attempting to obtain, or aiding another in obtaining or attempting to obtain credit for work or any improvement in evaluation of performance by any dishonest or deceptive means. Cheating includes, but is not limited to, the following.

<u>Taking information:</u>

1. Copying graded homework assignments from another student.
2. Working with others on a take-home test or homework (unless specifically accepted by the instructor).
3. Looking at another student's paper or screen during an examination.
4. Looking at text, notes, or electronic devices (e.g., cell phones, tablets, smart pens, unauthorized calculators, etc.) during an examination (unless specifically accepted by the instructor).
5. Accessing another student's electronic device (e.g., cell phone, tablet, laptop, desktop, etc.) and taking information from the device without consent.
6. Allowing another person to complete assignments or an on-line course.

<u>Providing information:</u>

1. Giving one's work to another to be copied or used in an oral presentation.
2. Giving answers to another student during an examination or for a take-home test.
3. Informing a person in a later section about questions appearing on an exam after taking that exam.
4. Providing a term paper to another student
5. Taking an exam, writing a paper, or creating a computer program for another student.

Plagiarism

Plagiarism is defined as submitting a term paper, essay, speech, laboratory report, or other assignment in which all or part of the words, ideas, or visuals are copied from the published or unpublished work of another individual without giving the original author proper credit for the words, ideas, or visuals. Such actions include, but are not limited to, the following.

1. Copying homework answers from a text to hand in for a grade.
2. Failing to give credit for ideas, statements, data, or conclusions derived by another author.
3. Failing to adequately summarize or paraphrase another's work.
4. Failing to use quotation marks when quoting directly from another, whether it be a paragraph, a sentence, or a part thereof.
5. Submitting a paper purchased from a research or term paper service or downloaded from the internet.
6. Copying another student's or a former student's paper and handing it in as one's own.
7. Giving a speech or oral presentation written by another and claiming it as one's own work.
8. Presenting another's computer program as one's own.
9. Failing to acknowledge the source of copied or adapted visuals.

Other Forms of Academic Dishonesty

Other forms of academic dishonesty include any actions intended to gain academic advantage by fraudulent and/or deceptive means not addressed specifically in the definition of cheating and/or plagiarism. These actions may include, but are not limited to, the following.
1. Planning with one or more fellow students to commit any form of academic dishonesty together.
2. Giving a term paper, speech, or project to another student when one knows or reasonably suspects that student will plagiarize it.
3. Having another student take one's exam, or complete one's computer program or lab experiment.
4. Lying to an instructor to increase a grade or gain additional time to complete an assignment or exam.
5. Submitting substantially the same paper or speech for credit in two different courses without prior approval of the instructors involved.
6. Altering a graded work after it has been returned, then submitting the work for regrading, without the instructor's prior approval.
7. Removing tests from a classroom without the approval of the instructor, or stealing tests.
8. Using a person's signature without permission.
9. Offering, giving, receiving, or soliciting a bribe of money, materials, goods, services, or anything of value for the purpose of procuring or providing an academic advantage.
10. Forging documents or other data, or omitting facts which are material to the purpose for which the information is submitted to the University, potential employers, or community members.
11. Possession of unauthorized equipment or materials during a test, quiz, or similar, whether found accessing or not.

Policy on Cheating, Plagiarism, and Other Forms of Academic Dishonesty

At faculty discretion, cheating may result in an F grade on the assignment or examination, or in the course. If a student does not accept the charge of cheating, s/he may bring the case to the Academic Standards Committee for review. Plagiarism may be considered a form of cheating and is, therefore, subject to the same consequences as cheating. However, as there may be plagiarism as a result of poor learning or inattention to format, and there may be no intent to deceive, some instructor discretion is appropriate. Under such circumstances, the instructor may elect to work with the student to correct the problem at an informal level. In any case that a penalty is applied, the student must be informed of the event being penalized and of the penalty.
The instructor shall contact the student with evidence of the academic dishonesty incident in writing within 10 business days of discovery of the event. The Academic Dishonesty Violation Referral form will also be submitted electronically to the Office of the Vice Chancellor for Academic Affairs. The instructor will show the student all evidence being considered and allow the student to fully respond. The instructor will notify the Vice Chancellor for Academic Affairs of the intended disciplinary action.

The Office of the Vice Chancellor for Academic Affairs shall determine if any further disciplinary action is required. In reported cases of repeated academic dishonesty, the Academic Standards Committee may be alerted and may apply additional penalties beyond those imposed by the individual instructors. Disciplinary actions might include, but are not limited to, reprimand; educational sanctions (completion of a report, paper, project, or workshop); loss of membership in organizations; or disciplinary probation, suspension, or expulsion from the University. If the Office of the Vice Chancellor for Academic Affairs and/or the Academic Standards Committee determines that no violation has occurred, the instructor will comply with the decision, and refrain from issuing penalties, or remove those already on the student's record.