MONTANA TECH
Department of Metallurgical and Materials Engineering

EMAT 472 Instructor: **Sudhakar Vadiraja, Ph.D., P.E.**
Materials Engineering & Design Office Hours: ELC 218, ×4267

Catalogue Description:
Students apply principles learned to the selection of materials and fabrication methods for the manufacture of components. Several case studies are drawn from engineering alloys, ceramics, polymers, composites, and natural materials. The course culminates in a design report submitted by the student, which is reviewed by the instructor at the end of the semester.

Credits: 2.0 Credit Hours (Lectures)

Designation: Required course (Metallurgical & Materials Engineering, General Engineering – Welding Option)

Prerequisites: EMAT 251 *or* EGEN 213 *or* permission of the instructor.

Required: M.F. Ashby, *Materials Selection in Mechanical Design*, 5th Edition, Butterworth-Heinemann, 2017, ISBN: 978-0-08-100599-6.

Additional References:
- D.R.H. Jones and Michael Ashby, *Engineering Materials 1, 5th Edition: An Introduction to Properties, Applications and Design*, Nov. 2018, ISBN: 978-0-08-102051-7
- Michael Ashby, Hugh Shercliff, and David Cebon, *Materials: Engineering, Science, Processing and Design*, 4th Edition Nov. 2018, ISBN: 978-0-08-102376-1

Relationship of Course to Metallurgical and Materials Engineering Program Outcomes:
This course builds on the fundamentals of materials engineering and uses them in materials selection and design.

Objectives: The objective of this course is to provide the student with:
1) Knowledge to prepare students for a career in metallurgical and materials engineering, providing a solid background in engineering alloys, ceramics, and polymers.
2) Exposure to materials processing (forming, coating, joining, etc) from a designing perspective.
3) Knowledge important to industry regarding material properties, effects of processing, shape selection, manufacturing and material costs and the interrelations between them.
4) Learning experience to use a methodology on how to select material for optimum performance.

Outcomes: Graduates of the course will or will be able to:
1) demonstrate a working knowledge of common engineering materials, relating material composition, processing, and mechanical properties,
2) derive design objectives and form material selection, shape and processing criteria,
3) apply multiple constraints, including costs,
4) select an optimum material for a given engineering application,
5) fulfill ABET outcomes **1, 2, 9 & 10** (*consult the Course Catalog and Department Guidelines*).

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	Tentative course plan	Forecast lectures
1	Materials Selection using CES EduPack 2018 software	3
2	Introduction to Materials Design and Properties (Ch 1 & 2)	3
3	Materials Property Charts (Ch 3)	3
4	Basics of Materials Selection (Ch 4) ….***Test 1***	3
5	Materials Selection - Case studies (Ch 5)	4
6	Processes and Their Effect on Properties (Ch 6)	3
7	Materials & Industrial Design - Case studies (Ch 15)	4
8	Sustainable Development & Recycling (Ch 16-Ashby & Ch 22-Callister)…..***Test 2***	3
	Tests & Review	4
	Total	30

Assessment:

Tests (2): *(25% each)*	50%
Term Project - *Oral presentation*	25%
Term Project - *Written technical report*	25%
Total	100%

Excessive absence lowers your grade

Grading:
A = (92-100), A− = (90-91.9), B+ = (88-89.9), B = (82-87.9), B− = (80-81.9), C+ = (78-79.9), C = (72-77.9), C− = (70-71.9), D+ = (68-69.9), D = (62-67.9), D− = (60-61.9), F = (0-59.9)

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.

Acts of academic dishonesty include but are not limited to:

- Aiding another student in an act of academic dishonesty
- Copying from another student's paper while taking a quiz or examination
- Plagiarism
- Unauthorized signatures (use of another person's signature without authorization)
- Using unlawful aids (books, notes, cell phones or other electronic devices, etc.) to pass an examination

Attendance:
Students are expected to attend at least 90% of the lectures. *Role may be taken randomly. Students who arrive after role is taken or depart prior to dismissal are considered absent.* Students must arrange to submit assignments, if any, in advance of field trips, athletics, or other school-sanctioned events that force them to miss class. Following an absence, students must arrange to obtain class notes from another student. The instructor's lecture notes are not available to students.

It is your responsibility to sit for the examinations at the scheduled dates and times. ***As a general rule, make-up quiz/test/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*.

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Requirements:

1. Attend all tests/exams/term paper presentations
2. **Talking with other students or sleeping in class or having ear phones during lecturing is prohibited and is considered disruptive behavior.**

Contribution to Professional Component:

Engineering Topics-	Yes
Engineering Design-	Yes (Material Selection)
Computer Usage-	Yes
Ethics-	Yes (Safety vs. Cost)
Statistics-	No
Safety-	Yes (incorporated in design)

ABET outcomes covered: 1, 2, 9 & 10

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
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.
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: **Sudhakar Vadiraja, Ph.D., P.E.**