First Undergraduate Online Course in Mechanical Engineering at SDSU Through D2L

**ME241: Engineering Materials**

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Presentation Outlines

1. Introduction
2. Multi-media Resources
3. Students’ Engagement
4. Course Assessment
5. Conclusions
6. Acknowledgement
1. INTRODUCTION
5 challenges to enhance teaching and learning for Generation Y:

– Creating learning environments that promote active learning, critical thinking, collaborative learning, and knowledge creation.
– Developing 21st century literacy (information, digital, and visual) among students and faculty.
– Reaching and engaging today's learners.
– Encouraging faculty adoption and innovation in teaching and learning with IT.
– Advancing innovation in teaching and learning with technology in an era of budget cuts.
The plan for South Dakota State University embraces the pedagogical challenge of educating the Generation Y, 21st Century learners. The essential elements of the plan are:

– Create the AL Cloud that enables the active teaching-learning environment (wifi, classroom, devices, virtualization).

– Establish student centered, faculty engage active learning environments based on curricula uniqueness (4-year implementation).

– Empower faculty through in-service programs with the insight, tools and savvy to adopt cutting edge discipline specific pedagogies that will ensure active learning environments (services through Cloud).

– Secure a sustainable resource base to implement and maintain the plan (funding).

– Demonstrate accountability and evaluate the plan outcome (assessment).
• College of Engineering benefiting
• Mechanical Engineering at South Dakota State University is one of the largest undergraduate programs on campus with around 320 undergraduate students enrolled in 2011.
• The Comfort Enrollment of Mechanical Engineering Program is 240, which is 80 students over the program comfort capacity.
• In order to improve the situation and effectively use the AL Cloud resource, one of the strategies is to develop blended/hybrid course learning and delivery.
• Challenges for teaching ME 241: Engineering Materials:
  – The topics, terminology, and even the way of thinking are new to most entry level students.
  – A standard science/engineering approach emphasizing formulae and numerical calculations can leave introductory-level students without a grasp of the basic principles of structure/property/processing relationships that are at the core of the subject.
  – An understanding of many of the topics requires the visualizations of three-dimensional moving images or evolving processes that cannot be presented effectively using static illustrations.
  – Students, particularly non-materials science and engineering majors, find a traditional lecture series that builds from electrons to atoms to crystals, etc., difficult to absorb.
  – Students typically exit a lecture without real comprehension of what was presented, because they were not able to pass the information from working memory to long-term memory at a rate commensurate with the delivery rate.
2. MULTI-MEDIA RESOURCES
Your Course Home
SOUTH DAKOTA STATE UNIVERSITY

...... Welcome to Visit My Web Site !!! ......

Zhong Hu, Ph.D.
Associate Professor

Areas of Research interests, industrial experience and teaching activities:

1. Computer Simulation Techniques:
   (i) Finite Element Method;
   (ii) Mesoscale Modeling;
   (iii) Quantum Mechanics/Molecular Modeling.

2. Materials Science and Engineering:
   (i) Advanced Materials Processing Technology; Metal Forming, Laser Forming, Net Shape Forming,
   Pipe Bending, etc;
   (ii) Materials Nanoscale Structure-Property Modeling;
   (iii) Photovoltaic Materials;
   (iv) Product Design/Optimization;
   (v) Polymers Injection Molding;
   (vi) Composite Structure optimization and property prediction; Composite Forming.

3. Mechanics:
   (i) Elasto-Plasticity;
   (ii) Advanced Strength and Failure Theory;
   (iii) Dynamics.

4. Mechanical Engineering:
   (i) Fundamentals of Machine Design;
   (ii) Kinematics and Dynamics of Machinery;
   (iii) Strength Design and Failure Evaluation of Machinery;
   (iv) Automatic Control.

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Web Site: http://tech.sdstate.edu/users/Zhong_Hu/
Your Syllabus

ME 241-S01: Engineering Materials (3 Credits)
South Dakota State University
Fall 2008
Mon.-Wed.-Fri. 1:00-1:50PM at SCEA 249

Instructor’s Contact Information
Name: Dr. Zhong Hu
Office: CEH 222
Office hours: Monday to Friday 4:00 – 5:00PM
Office phone number: 688-4617
E-mail address: Zhong.Hu@cestate.edu

Course Description
Catalog description: Structure of materials, including structure in nanoscale, such as atoms, perfect and imperfect crystals and phases, and non-crystals. Diffusion mechanisms. Mechanical properties of metals, and dislocations and strengthening mechanisms. Failure theory. Phase diagram and phase transformations in metals, including development of microstructure and alteration of mechanical properties. Applications and processing of metal alloys, ceramics, polymers and composites.

Course Prerequisites
Previous course experience: Math 123, Chem 112.
Technology skills (http://learn.sdstate.edu/online-require.htm)

Description of Instructional Methods
The course instructional methods in this semester are in the transition period. This course will involve class lectures, presentations, discussions, experiments, videos, and on-site tour, with D2L enhancement. We will deliver all the formal lecture in the class as usual, and you may also find the course contents, self-tests, assignments, announcements, your grades, and a lot of relevant information on the D2L. It can be accessed through the internet from computer labs or from your personal computer at http://d2l.sdstate.edu

Technical Support: Helpdesk 605-688-6776 or SDSU.supportdesk@sdstate.edu, or website at http://www3.sdstate.edu/Technology/Support/InformationTechnologyServices/

Distance Education Support: http://distance.sdstate.edu/

Course Requirements
Class attendance is highly recommended but will not be graded, however, as the transition period of an online course, students are responsible for all material presented in the classes, i.e., announcements, assignments, quizzes, tests, etc.

Online contents
Cheating and plagiarism policy: Refer to the student handbook. (http://studentaffairs.sdstate.edu/JudicialAffairs/StudentCode/SDSU_Student_Code.pdf)
Make-up policy: If a quiz, a test, or an assignment is missed, the grade will be recorded as zero except in the event of an illness or serious emergency. In general, no excuse will be valid without contacting the instructor prior to the
Case Study – Material Selection

- **Problem:** Select suitable material for bicycle frame and fork.

<table>
<thead>
<tr>
<th>Steel and alloys</th>
<th>Wood</th>
<th>Carbon fiber Reinforced plastic</th>
<th>Aluminate alloys</th>
<th>Ti and Mg alloys</th>
</tr>
</thead>
</table>

**Cost important? Select steel**
**Properties important? Select CFRP**
Your Video Clips
Your Web-links

Categories
- Publisher for textbook
- Professional Societies
- Other Useful Links
- Materials Science in industry

Instructions
- All Links are listed to the right in their respective categories
- Change the category selection to view a specific category

Links

Publisher for textbook

McGraw Hill: Publisher for the textbook.

Professional Societies
- American Society for Engineering Education
- American Society for Mechanical Engineers
- The Materials Information Society
- American Plastics Council
- American Society for Nondestructive Testing
- Association of American Ceramic Component Manufacturers
- American Ceramics Society
- The American National Standards Institute
- The National Aeronautics and Space Administration
- Society of Plastics Engineers
- The Minerals, Metals and Materials Society

Other Useful Links
- Good reference site for Engineering students
- Materials Science Center
- Site on crystal structures
- Information on elements of periodic table
- Information on materials, properties and applications
- Information on stainless steel
- Gallery of materials
- Other useful links

(Other Useful Links)
3. STUDENTS’ ENGAGEMENT
Your News Board
### Your Assignments

<table>
<thead>
<tr>
<th>Folder</th>
<th>Total Files</th>
<th>Unread Files</th>
<th>Flagged Files</th>
<th>Actions</th>
</tr>
</thead>
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<td>0</td>
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<tr>
<td>Assignment No. 8</td>
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#### Files

- **J BA.doc** (269.5 KB) | Sep 12, 2008 1:37 PM | Leave Feedback
- **Assignment1.docx** (121.69 KB) | Sep 12, 2008 4:56 PM | Leave Feedback

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2.39. Calculate the net potential energy for K'Br pair by using the b constant calculated from problem 2.37.

From equation 2.8:

\[ E_{\text{ui}} = \frac{Z_1 Z_2 e^2}{4 \pi \varepsilon_0} \frac{b}{a^n} \]

\[ 2.1265 \times 10^{-2} N = \frac{9.5 b}{(3.28 \times 10^{10})^3} \]

\[ b = 5.84316 \times 10^{-16} \]

\[
(\frac{(-1)-1}{\sqrt{16} \times 10^{-19}})^2 + \frac{\left(5.843 \times 10^{-16} \times m_{K'}\right)}{(3.28 \times 10^{-10})^3} = E_{K' - Br} = -6.28 \times 10^{-18} J
\]
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Author</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 25, 2008 8:52 AM</td>
<td></td>
<td>Zhang Hu</td>
<td>Re: Outer shell of electrons completely filled</td>
</tr>
<tr>
<td>Sep 25, 2008 8:14 AM</td>
<td></td>
<td>Zheng Hu</td>
<td>Re: Bond energies</td>
</tr>
<tr>
<td>Sep 25, 2008 8:10 AM</td>
<td></td>
<td>Rachel Duncan</td>
<td>Re: Bond energies</td>
</tr>
<tr>
<td>Sep 24, 2008 8:00 AM</td>
<td></td>
<td>Tyler Brokel</td>
<td>Re: Bond energies</td>
</tr>
</tbody>
</table>

That is right, for any element, the max number of electrons in the outer most shell is 8 except the when n=1 such as He, the max number of electrons in the outer most shell has only 2 electrons. This is determined by the energy states in which electrons usually fill the lower level.

I looked at the periodic table and selected an element in the column next to the noble gases, i.e. I.
Your Email Box
4. COURSE ASSESSMENT
**Your Quiz**

**Chapter 2**

**Est. Length:** 0:50:00  **Time Taken:** 0 min

**Quiz Info**

**Zhong Hu**

**Attempt 1**

**Questions**

**Page 1:**

1  2  3  4  5

6  7  8  9  10

11  12  13  14  15

16  17  18  19  20

Legend

Saved Response  Unsaved Response  Info Item

**Quiz Status**

Quiz Started

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**Question 1**

The nucleus of an atom contains:

- A. Protons
- B. Electrons
- C. Neutrons
- D. All of the above
- E. Both A and C

**Question 2**

What type(s) of electron subshell(s) does an L shell contain?

- d
- p
- f
- s
- s and f
- s and p
- All of the above

**Question 3**

How many atoms or molecules are there in a mole of a substance?

- $6.023 \times 10^{-23}$
- $6.023 \times 10^{23}$
- $1.66 \times 10^{-23}$
- 1
- $1.66 \times 10^{23}$

**Question 4**

What is the maximum number of electrons that an M shell may contain?

- 18
- 8
- 2
- 32
- All of the above
(Totally 26 multi-choice problems)

1. How many atoms are there in 100 g of gold? \( N_A = 6.023 \times 10^{23} \) atoms/mol, \( A_{Au} = 196.97 \) g/mol
   - (a) 196.97 \times 100 \text{ atoms}
   - (b) 0.5077 \times 6.023 \times 10^{23} \text{ atoms}
   - (c) 6.023 \times 10^{23} \text{ atoms}
   - (d) 100 \times 6.023 \times 10^{23} \text{ atoms}

2. A monel alloy consists of 70 wt% Ni and 30 wt% Cu. What are the atomic percentages of Ni and Cu in this alloy? \( A_{Ni} = 58.69 \) g/mol, \( A_{Cu} = 63.55 \) g/mol
   - (a) 30 at% Ni, 70 at% Cu
   - (b) 58.69 at% Ni, 36.35 at% Cu
   - (c) 71.6 at% Ni, 28.4 at% Cu
   - (d) 70 at% Ni, 30 at% Cu

3. Calculate the energy in joules of the proton whose wave length is 303.4 nm. \( \Delta E = h \nu \), Plank’s constant \( h = 6.63 \times 10^{-34} \text{ J s} \), the light velocity \( c = 3.00 \times 10^8 \text{ m/s} \)
   - (a) 6.71 \times 10^{-20} \text{ J}
   - (b) 6.71 \times 10^{-12} \text{ J}
   - (c) 6.56 \times 10^{-28} \text{ J}
   - (d) 6.56 \times 10^{-19} \text{ J}

4. A hydrogen atom exists with its electron in the \( n=6 \) state. The electron undergoes a transition to the \( n=2 \) state. Calculate the frequency of the photon emitted. \( E_n = -13.6/n^2 \text{ eV} \), 1 eV = \( 1.60 \times 10^{-19} \) J
   - (a) 4.6 \times 10^{35} \text{ Hz}
   - (b) 7.3 \times 10^{14} \text{ Hz}
   - (c) 7.3 \times 10^{5} \text{ Hz}
   - (d) 4.6 \times 10^{3} \text{ Hz}

5. What is the maximum number of electrons that an \( Mn=3 \) shell may contain?
   - (a) 2
   - (b) 8
   - (c) 18
   - (d) 32
Your Grades

Instructions

- The Grades tool is used to create grade items and schemes for measuring users' performance; record grades; and share a grade book and statistics with users.
- Use this page to view, create, edit, and delete grade items and categories.
# Student Survey Summary

<table>
<thead>
<tr>
<th>Survey Items</th>
<th>Fall 2008</th>
<th>Spring 2009</th>
<th>Fall 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received/Sent Out Surveys</td>
<td>26/27</td>
<td>26/27</td>
<td>33/36</td>
</tr>
<tr>
<td>Do you have e-learning experience in the past?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes: 8 (31%)</td>
<td>Yes: 6 (23%)</td>
<td>Yes: 11 (33%)</td>
<td></td>
</tr>
<tr>
<td>No: 18 (69%)</td>
<td>No: 20 (77%)</td>
<td>No: 22 (67%)</td>
<td></td>
</tr>
<tr>
<td>What was the most helpful thing about this delivery?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility: 14</td>
<td>Flexibility: 14</td>
<td>Flexibility: 13</td>
<td></td>
</tr>
<tr>
<td>Online resource: 17</td>
<td>Online resource: 15</td>
<td>Online resource: 21</td>
<td></td>
</tr>
<tr>
<td>What was the least helpful thing about this delivery?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less f2f class &amp; interaction: 19</td>
<td>Less f2f class &amp; interaction: 14</td>
<td>Less f2f class &amp; interaction: 22</td>
<td></td>
</tr>
<tr>
<td>Others: 9</td>
<td>Others: 13</td>
<td>Others: 11</td>
<td></td>
</tr>
<tr>
<td>What did you like about the way the course delivered?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others: 7</td>
<td>Others: 4</td>
<td>Others: 3</td>
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<tr>
<td>Be interested in taking other courses like this one?</td>
<td></td>
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<tr>
<td>Yes: 15 (58%)</td>
<td>Yes: 8 (31%)</td>
<td>Yes: 16 (48%)</td>
<td></td>
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<tr>
<td>No: 3 (11%)</td>
<td>No: 4 (15%)</td>
<td>No: 3 (9%)</td>
<td></td>
</tr>
<tr>
<td>Maybe: 8 (31%)</td>
<td>Maybe: 14 (54%)</td>
<td>Maybe: 14 (42%)</td>
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<tr>
<td>Was it more difficult to achieve better grades?</td>
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<tr>
<td>Yes: 14 (54%)</td>
<td>Yes: 14 (54%)</td>
<td>Yes: 17 (52%)</td>
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<tr>
<td>No: 12 (46%)</td>
<td>No: 12 (46%)</td>
<td>No: 16 (48%)</td>
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</tbody>
</table>
5. CONCLUSIONS

• A hybrid or blended course requires careful pedagogical redesign, careful redesign of learning contents, learning process consideration, teaching methods and evaluation.

• South Dakota State University is developing an AL Cloud which makes blended/hybrid course redesign possible and more effective.

• This case study indicates that blended/hybrid learning provides a better ideology for the choice of learning methods when different e-learning tools are available for online and in-class dual environment.
6. ACKNOWLEDGMENTS

Special thanks to: Instructional Design Services, AL Cloud Project/Faculty Development and the Office of Academic Affairs at SDSU for the faculty training opportunity and technical support and ASEE Best Practice in Engineering Education Committee for providing the opportunity to present this work. The author would also like to thank SDSU, the College of Engineering, the Department of Mechanical Engineering and the colleagues for supporting developing the online course.
Questions