Boise State University
Foundational Studies Program Course Application Form
Due to the Foundational Studies Program by August 19, 2011

After the Foundational Studies Program has approved a course, departments will continue through the regular department and college procedures. The approved course should be submitted to the University Curriculum Committee by October 1, 2011.

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Instructions:

1. Complete one form per course.
2. Attach this Foundational Studies Course Application Form to the back of the University Curriculum Committee “Request for Curriculum Action” form. Both forms should be submitted to the Foundational Studies Program Office by August 19, 2011.

Part I. Course Information

Course Number and Title: ENGR 245: Introduction to Material Science and Engineering

Type of Foundational Studies Course – (Choose One):

[ ] DLS (Disciplinary Lens – Social Science)
[ ] DLL (Disciplinary Lens – Literature and Humanities)
[ ] DLV (Disciplinary Lens – Visual and Performing Arts)
[ ] DLM (Disciplinary Lens – Mathematics)
[x] DLN (Disciplinary Lens – Natural, Physical, and Applied Sciences)
   Includes Lab: [ ] Yes [x] No
[ ] CID (Communication in the Discipline)
[ ] FF (Finishing Foundations)

Delivery Format(s) – (Check all that apply):

[x] Face to Face
[x] Fully Online
[ ] Hybrid
[ ] Concurrent Enrollment
[ ] Other (briefly describe):
Part II. Syllabus Statement

Boise State's Foundational Studies Program provides undergraduates with a broad-based education that spans the entire university experience. ENGR 245 satisfies 3 credits of the Foundational Studies Program's Disciplinary Lens – Natural, Physical and Applied Science requirements. It supports the following University Learning Outcomes, along with a variety of other course-specific goals.

ULO 8. Apply knowledge and methods characteristic of scientific inquiry to think critically about and solve theoretical and practical problems about physical structures and processes.

ENGR 245: Introduction to Material Science and Engineering introduces the relationships between structure, property, processing and performance of materials used in all aspects of society. These materials include metals, ceramics, polymers and composites. This course helps to achieve the goals of the Foundational Studies Program by focusing on the following course learning outcomes.

After successful completion of this course, you will be able to:

- Understand and use technical language to describe the structure, properties, processing and performance of materials.
- Explain how an external change to a material (such as a change in temperature, or an applied stress), and/or an internal change (such as the addition of a solute to a material, or a phase change) affects the structure, properties, processing and/or performance of materials.
- Collect and/or interpret materials data to form conclusions about their structure, properties, processing and/or performance.
- Confirm existing explanations or models (theories) for materials behavior (e.g. elastic behavior of materials) using evidence (data) and/or observations.

Part III. Design for Accessibility

In the space below, briefly describe plans for providing access to course materials and activities (or equivalent alternatives) to all students in adherence with the Americans with Disabilities Act. Although these plans may vary from instructor to instructor, the descriptions provided below should be representative of intended departmental and instructor practices. (See example statements appended to this form.)

ENGR 245: Introduction to Material Science and Engineering: Materials utilized or distributed in class will also be posted on Blackboard, with sufficient resolution to allow magnification with fidelity. PowerPoints used in class lectures, insofar as they contain graphs or other visual representations of content, will be verbally described to students on an as-needed basis. We will add textual descriptions accessible by screen readers to images used on the course web site. Extra time on tests, oral examinations, or other accommodations will be provided to students as needed per the policies of the Disability Resource center.
Part IV. Evidence of Quality Course Design

Please use the table below (column headings for this table should not be changed) to provide evidence that the course has been carefully designed and is clearly aligned with Foundational Studies Program desired ULOs. All sections of the course should share similar student learning outcomes. Teaching and Learning Activities and Assessment Methods may vary from instructor to instructor. Please use the table to report representative strategies that may be used. Assessment activities used for reporting to the Foundational Studies Program should be consistent across different sections of the course.

Please see below.
Boise State University  
Foundational Studies Course  
Spring 2014  

Course Number and Title: ENGR 245: Introduction to Material Science and Engineering

### Course Design Table

<table>
<thead>
<tr>
<th>Foundation ULO 8 Criteria</th>
<th>Foundation ULO 8 Notions of Exemplary Work</th>
<th>Course Learning Outcomes: By the end of this course, each student should be able to…</th>
<th>Assessment Method: Evidence of Student Learning</th>
<th>Planned Teaching &amp; Learning Activities / Pedagogy</th>
</tr>
</thead>
</table>
| ULO 8.1: Process of Inquiry and Analysis in Response to Evidence or Observation | * Skillfully and thoroughly formulates a research question or testable hypothesis.  
* Constructs a model to test evidence and observations  
* Skillfully uses model to either confirm existing explanations or formulate new hypotheses | Confirm existing explanations or models (theories) for materials behavior (e.g. elastic behavior of materials) using evidence (data) and/or observations. | * Assignment: Given the following material’s DATA, calculate the PROPERTY for this material. What relationship (or model, or theory) is exhibited by this DATA? Fundamentally, within the material, what is happening in order to exhibit this relationship?  
* Develop a rubric to assess such an assignment, using (for example) a four-point scale. Apply to one or two assignments completed by all students in class; analyze results. | Example: Given a stress-strain curve, calculate the elastic modulus for the material. Explain what is happening in the material in order for this behavior to occur.  
* Example of planned teaching activities to accompany assignment:  
In class – use video clip to watch a metal test sample be pulled apart to failure in a tensile test; Use this data for the assignment (i.e. have students calculate the elastic modulus of the material) . This assignment can be done as homework, in-class in groups.  
In-class – distribute paperclips. Bend the paperclip gently (elastically); notice how it recovers its original shape. Now bend it a lot (to achieve plastic deformation). Have students discuss, in-class, which part of a stress strain curve each of those behaviors belongs. |
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| ULO 8.2: Understanding of Knowledge and Inquiry | * Clearly understands the difference between evidence (data) and explanation (theory)  
* Is able to connect evidence & explanation to build an argument  
* Understands the role of these kinds of arguments in building knowledge in the discipline | Collect and/or interpret materials data to form conclusions about their structure, properties, processing and/or performance. | * Assignment suitable for homework, in class assignment, quiz or exam question: Given the following set of DATA, which materials provides the highest PROPERTY, and why?  
* Develop appropriate rubric; apply to one or two assignments completed by all students in class; analyze results. | Example: Given a series of micrographs taken from an alloy system that has different levels of solute added, which alloy has the highest electrical conductivity? Why? Be specific in your response and use technical language. |
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<td><strong>ULO 8.3:</strong> Communication of Scientific and/or Technological Understandings</td>
<td>* Produces clear, accurate, well-organized written and oral communications about scientific and technological understandings</td>
<td>Understand and use technical language to describe the structure, properties, processing and performance of materials.</td>
<td>* Assignment suitable for homework, in class assignment, quiz or exam question: Ask students to explain in a paragraph consisting of several sentences, what happens to the material in response to a certain physical change to it. Indicate that an illustration, or plot of behavior as a function of physical change, may be needed as part of the explanation</td>
<td>* Example: In a solid, how does diffusion occur? Explain the mechanism by which atoms can move in a crystalline solid. What is the effect of increasing temperature on diffusivity? Be specific in your response and use technical language.</td>
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<td>* Use of scientific language, representational tools, and notation covered in the course is skillful.</td>
<td>* Develop appropriate rubric; apply to one or two assignments completed by all students in class; analyze results.</td>
<td>* Example teaching/learning activity: Standard explanation can be given, with illustrations; if desired, a vacancy exchange exercise can be done in class to illustrate both that concept and also the effect of increased temperature on diffusion. Exercise can be done with large, single color pieces of paper “atoms” and same size pieces of paper, but white, “vacancies.” Depending on the classroom configuration and how full it is, people can simulate atom sites by holding pieces of paper and exchanging full sites with vacant sites. Can increase the crystal “temperature” – pass out more vacancy papers (white).</td>
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<td>Note: one assignment, with different rubrics, may be used to assess both this outcome as well as another (see below).</td>
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<td>ULO 8.4: Understanding of interactions of science and technology with humans and environment</td>
<td>* Skillfully assesses the potential connection of scientific and/or technological developments to humans and the environment</td>
<td>Explain how an external change to a material (such as a change in temperature, or an applied stress), and/or an internal change (such as the addition of a solute to a material, or a phase change) affects the structure, properties, processing and/or performance of materials.</td>
<td>* Assignment suitable for homework, in class assignment, quiz or exam question: Ask students to explain in a paragraph consisting of several sentences, what happens to the material in response to a certain physical change to it. Indicate that an illustration, or plot of behavior as a function of physical change, may be needed as part of the explanation.</td>
<td>* Develop appropriate rubric; apply to one or two assignments completed by all students in class; analyze results. Example: In a solid, how does diffusion occur? Explain the mechanism by which atoms can move in a crystalline solid. What is the effect of increasing temperature on diffusivity?</td>
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5-16-2013

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Foundational Studies Program Director Signature

Date