ARIZONA STATE UNIVERSITY
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GENERAL STUDIES PROGRAM COURSE PROPOSAL COVER FORM

Courses submitted to the GSC between 2/1 and 4/30 if approved, will be effective the following Spring.
Courses submitted between 5/1 and 1/31 if approved, will be effective the following Fall.

(SUBMISSION VIA ADOBE.PDF FILES IS PREFERRED)

DATE 4/4/11

1. ACADEMIC UNIT: Ira A. Fulton Schools of Engineering

2. COURSE PROPOSED: FSE 194 Perspectives on Grand Challenges for Engineering 3
   (prefix) (number) (title) (semester hours)

3. CONTACT PERSON:
   Name: Ann Zell
   Phone: 5-8831
   Mail Code: 8109 E-Mail: ann.zell@asu.edu

4. ELIGIBILITY: New courses must be approved by the Tempe Campus Curriculum Subcommittee and must have a regular course number. For the rules governing approval of omnibus courses, contact the General Studies Program Office at 985-0739.

5. AREA(S) PROPOSED COURSE WILL SERVE. A single course may be proposed for more than one core or awareness area. A course may satisfy a core area requirement and more than one awareness area requirements concurrently, but may not satisfy requirements in two core areas simultaneously, even if approved for those areas. With departmental consent, an approved General Studies course may be counted toward both the General Studies requirement and the major program of study. (Please submit one designation per proposal)

   Core Areas
   Literacy and Critical Inquiry–L □
   Mathematical Studies–MA □
   CS □
   Humanities, Fine Arts and Design–HU □
   Social and Behavioral Sciences–SB □
   Natural Sciences–SQ □ SG □

   Awareness Areas
   Global Awareness–G □
   Historical Awareness–H □
   Cultural Diversity in the United States–C □

6. DOCUMENTATION REQUIRED.
   (1) Course Description
   (2) Course Syllabus
   (3) Criteria Checklist for the area
   (4) Table of Contents from the textbook used, if available

7. In the space provided below (or on a separate sheet), please also provide a description of how the course meets the specific criteria in the area for which the course is being proposed.

   Attached.

   CROSS-LISTED COURSES: □ No □ Yes; Please identify courses:

   Is this an amultisection course?: □ No □ Yes; Is it governed by a common syllabus?

   James Collofello, Associate Dean
   Chair/Director (Print or Type)
   Date:

   Chair/Director (Signature)

Rev. 1/94, 4/95, 7/98, 4/00, 1/02, 10/08
Arizona State University Criteria Checklist for

GLOBAL AWARENESS [G]

Rationale and Objectives

Human organizations and relationships have evolved from being family and village centered to modern global interdependence. The greatest challenge in the nuclear age is developing and maintaining a global perspective which fosters international cooperation. While the modern world is comprised of politically independent states, people must transcend nationalism and recognize the significant interdependence among peoples of the world. The exposure of students to different cultural systems provides the background of thought necessary to developing a global perspective.

Cultural learning is present in many disciplines. Exposure to perspectives on art, business, engineering, music, and the natural and social sciences that lead to an understanding of the contemporary world supports the view that intercultural interaction has become a daily necessity. The complexity of American society forces people to balance regional and national goals with global concerns. Many of the most serious problems are world issues and require solutions which exhibit mutuality and reciprocity. No longer are hunger, ecology, health care delivery, language planning, information exchanges, economic and social developments, law, technology transfer, philosophy, and the arts solely national concerns; they affect all the people of the world. Survival may be dependent on the ability to generate global solutions to some of the most pressing problems.

The word university, from universitas, implies that knowledge comes from many sources and is not restricted to local, regional, or national perspectives. The Global Awareness Area recognizes the need for an understanding of the values, elements, and social processes of cultures other than the culture of the United States. Learning which recognizes the nature of others cultures and the relationship of America’s cultural system to generic human goals and welfare will help create the multicultural and global perspective necessary for effective interaction in the human community.

Courses which meet the requirement in global awareness are of one or more of the following types: (1) in-depth area studies which are concerned with an examination of culture-specific elements of a region of the world, country, or culture group, (2) the study of contemporary non-English language courses that have a significant cultural component, (3) comparative cultural studies with an emphasis on non-U.S. areas, and (4) in-depth studies of non-U.S. centered cultural interrelationships of global scope such as the global interdependence produced by problems of world ecology, multinational corporations, migration, and the threat of nuclear war.
Proposer: Please complete the following section and attach appropriate documentation.

### ASU--[G] CRITERIA

#### GLOBAL AWARENESS [G]

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>Identify Documentation Submitted</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>1. Studies <strong>must</strong> be composed of subject matter that addresses or leads to an understanding of the contemporary world outside the U.S.</td>
</tr>
<tr>
<td>✔️</td>
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<td>2. Course must be <strong>one or more</strong> of following types (check all which may apply):</td>
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<tr>
<td></td>
<td></td>
<td>a. In-depth area studies which are concerned with an examination of culture-specific elements of a region, country or culture group. <strong>The area or culture studied must be non-U.S. and the study must contribute to an understanding of the contemporary world.</strong></td>
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<td>b. Contemporary non-English language courses that have a significant cultural component.</td>
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<td></td>
<td></td>
<td>c. Comparative cultural studies in which most, i.e., more than half, of the material is devoted to non-U.S. areas.</td>
</tr>
<tr>
<td>✔️</td>
<td></td>
<td>d. In-depth studies of non-U.S. centered cultural interrelationships of global scope, such as the global interdependence produced by problems of world ecology, multinational corporations, migration, and the threat of nuclear war. <strong>Most, i.e., more than half, of the material must be devoted to non-U.S.</strong></td>
</tr>
</tbody>
</table>
Explain in detail which student activities correspond to the specific designation criteria. Please use the following organizer to explain how the criteria are being met.

<table>
<thead>
<tr>
<th>Criteria (from checksheet)</th>
<th>How course meets spirit (contextualize specific examples in next column)</th>
<th>Please provide detailed evidence of how course meets criteria (i.e., where in syllabus)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Course offers students a global perspective of providing solutions to the Grand Challenges facing our civilization in the 21st century. The course will deal with topics that transcend national boundaries and analyze the flow of information, ideas, resources and technology among different societies.</td>
<td>The activities during the first part of the course and readings from J.F. Richard's High Noon, Tom Friedman's book &quot;Hot, flat and crowded&quot; and Lester Brown's book &quot;Plan B 4.0: Mobilizing to Save Civilization&quot; will empower students to engage in thought provoking problem solving exercises.</td>
</tr>
<tr>
<td>2d</td>
<td>The course provides an introduction to the issues on a global scale and how developed and developing countries can work together on sustainable technologies, practical and sensible policies to address these complex challenges.</td>
<td>Analyzing the paths taken by different countries across the globe at various times in history will offer the students an opportunity to understand how the present day global challenges can only be addressed by a mutual respect among countries and reciprocal agreements, as indeed the survival of our species may depend on it.</td>
</tr>
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Perspectives on Grand Challenges for Engineering

Organizing Instructor: B.L. Ramakrishna

Fall 2011: FSE 194 Monday from 4:40 to 7:30 PM

This 3-credit course is offered to satisfy general studies requirements in the curriculum. The content of the course is designed to adequately address the Social & Behavioral Sciences (SB) core area and also expected to meet requirements in the historical and global awareness areas.

This course, centered around the grand challenges for engineering in the 21st century, will offer the opportunity for students to develop a truly cross disciplinary appreciation for the grand challenges from a social, global and historic perspective. It will help build a foundation to understand the present challenges facing humanity by discussing the challenges faced by societies across the globe throughout our history over the past 12,000 years and how earlier societies addressed (or in some cases, failed to address) the challenges. The history of technology begins with the simplest Stone Age tools and ceramics and continues to the present day of computers, communications and space travel. While history of technology can claim to be basically secular, there are a multitude of forces that guide what technologies are adopted by a given society to address the specific challenges they face. The structure of the course is designed such that the undergraduates will develop an in-depth understanding of the grand challenges through the lenses of both engineering/technology and the social & behavioral sciences. This approach will illustrate to the students that how societies react to the challenges they face and what technologies are developed and deployed to address them is a product of a complex interaction between history, social systems, global pressures and political vision.

The course will start with an introduction to a carefully selected set of challenges that have been met by societies in the past. For example, the students will discuss how the challenges of urban housing and information storage were addressed in the Neolithic age through clays and ceramics; how the Great Wall of China was built as a response to security challenges; how the Roman road system was constructed to meet the need for transportation of goods and armies; how horses, water and wind drove the simple machines that ground our grain before the steam engine; that the Roman aqueducts, the Hohokom canals and the central Arizona project were all in response to the challenge of providing access to water; how natural fiber and ceramic pots rose to the challenge of food storage before being replaced by steel, tin cans, refrigeration and plastics and how the industrial revolution was propelled by need for large scale manufacturing, controlling labor costs, Further, the course will explore the societal connections to the challenges as well the chosen solutions and the impact on society by the consequences of those challenges being met or not met adequately. In summary, the students will gain an
understanding about how societies can learn from the historical context of engineering.

After gaining a historical perspective, the students will be illuminated about a selected number of the Grand Challenges through guest lectures from faculty on the ASU campus from numerous disciplines, who are actively engaged in cutting edge research aligned to the Grand Challenges. Each Challenge presented to the students will emphasize the global and societal importance of solving them in addition to the technological difficulties. The students will also begin to appreciate how the present priorities of people and governments from different parts of the world depend on their respective historical and cultural aspects. The course will illustrate the necessity to create a global network of engineers and technologists developing synergistic working relationships with not only each other but also with social scientists and policy makers to adequately solve the world’s problems. Issues such as health care, technology transfer, environmental pollution and water scarcity will take on global and social dimensions. The students will be expected to work in groups to create reports assessing the social consequences of the grand challenges on economic, technological, political, and cultural fabric of society. In particular, the students will need to take into account the views of the BRIC (Brazil, Russia, India and China) and other countries on choosing sensible and practical approaches to addressing the grand challenges for the 21st century.

The course outcomes are

1. Gain an appreciation for the challenges faced by humanity throughout history.
2. Appreciate the cultural and societal differences around the world and especially how it influences the use of technology to solve problems
3. Understand the economic, political, cultural and societal implications for solving the problems that are global in scope
4. Learn to apply their knowledge and experience to a more global and societal setting and to develop their role in addressing future global endeavors
5. Acquire the skills and knowledge needed to solve complex global problems and compete in the increasingly technological global economy
6. Learn to manage technology to solve global problems in a sustainable way. 21st century workforce
Perspectives on Grand Challenges for Engineering

Course Syllabus

Organizing Instructor: B.L. Ramakrishna
Fall 2011: FSE 194 Monday from 4:40 to 7:30 PM

This 3-credit course is offered to satisfy general studies requirements in the curriculum. The content of the course is designed to adequately address the Social & Behavioral Sciences (SB) core area and also expected to meet requirements in the historical and global awareness areas.

Course Description & Goals

This course, centered on the theme of National Academy of Engineering’s (NAE) Grand Challenges for Engineering in the 21st century, will offer the opportunity for students to develop an interdisciplinary appreciation for the Grand Challenges from a global and historical perspective. It will help build a foundation to understand the present challenges facing humanity by discussing the challenges faced by societies across the globe throughout our history. It will provide them glimpses of research/internship experience, entrepreneurship, global dimensionality of issues, and service learning through the various lenses of societal implications and history. This course will shape their undergraduate educational experience by being able to understand both the social and historical complexities of meeting the needs of local and global challenges through engineering and technology.

Readings

Required texts:
Plan B 4.0 by Lester Brown
High Noon: Twenty Global Problems, Twenty Years to Solve Them by J.F. Richard

Additional Resources:
NAE's website on Grand Challenges
Hot, Flat, and Crowded by Thomas Friedman
Guns Germs and Steel by Jared Diamond
Common Wealth: Economics for a Crowded Planet by Jeffrey D. Sachs
UN's Millennium project http://www.unmillenniumproject.org/
Science and Technology in World History by J.E. McClellan and H. Dorn
The Nature of Technology by W.B. Arthur

In addition several selected papers and articles will be made available as needed.
Course Organization, Requirements and Assignments

This course is designed to provide the necessary background knowledge needed for students to fully engage in selected NAE’s Grand Challenges. The Grand Challenges covered will include: economical solar energy, carbon sequestration, access to clean water, engineering better medicines, restoring urban infrastructure and personalized learning. Further, this course will cover some of the challenges that have been addressed by earlier societies through engineering and technology, and the social outcomes of meeting (or in some cases, not adequately meeting) those challenges. There will be no exams to evaluate student performance. Instead the following criteria and requirements will be used to grade student performance.

1) Class Participation

The course will be offered in a seminar style, which requires the students to bear partial responsibility for the conduct of the class. All students are expected to have read assigned readings prior to class and to be prepared to discuss those readings in class. Students are required to participate in a blog on the Grand Challenges. This activity is modeled after the worldwide contributions on the NAE’s web site. A portion of the grade will rest on attendance, active participation, and contribution to the in-class discussions. The course is designed to maximize group interaction and student initiative.

2) Individual Paper

After students have been exposed to the Grand Challenges and a historical perspective on past engineering challenges, they will be asked to choose a grand challenge that interests them most and write a paper regarding the relevance this course material has to their undergraduate curriculum and their future goals; including career paths, extracurricular involvement, social entrepreneurship and outreach. In their paper, the students will need to address the how the views of the developed countries such as the US, Germany and Japan could be balanced with the views of BRIC (Brazil, Russia, India and China) and other developing countries on choosing sensible and practical approaches to addressing the grand challenges for the 21st century. The paper will be about 2000 words.

3) Questions

Prior to each seminar session on the grand challenges, students will be expected to submit 5 questions based on the assigned reading material. The questions, posted on the Blackboard prior to class, will allow the students to
lead a vibrant discussion during class and also will be used as a tool by the
guest lecturers to tailor their presentations/discussions in order to provide
the maximum benefit to the students. On blackboard, each student will then
have to answer one of the questions provided by their peers. The response is
expected to be about 500 words.

4) Group Project

Students in this course are required to work on a major project as a member
of a larger group. This project will give the students the opportunity to work
on projects that are aligned with their interests. Projects could be geared
towards one of the following paths chosen by the group: social
entrepreneurship, education/outreach, research, global dimension or
internship, etc. Important points to cover in the paper include: historical lens
of the challenge (learning from previous mistakes), societal implication for
meeting the challenge, how the project applies to the NAEs Grand
Challenges, detailed project implementation plan, and future directions. The
project paper will describe in detail the leadership role the students
undertook in their chosen sphere of activity. The paper will be about 2000
words long. There will also be a presentation by each group.

Grading Procedures

Students' final grades will be determined as follows:

**Individual Paper** ........................................20%

**Questions and responses** .........................30%

Questions ..................5%
Quality of Responses ….25%

**Group Project** ..........................................40%

Mid-Project Update Presentation ......5%
Final Project Paper .....................25%
Final Project Presentation ..........10%

**Participation /Attendance**
/Discussions/contributions to class ............10%

The participation of all individuals in the class is needed to maximize the learning
environment for all students. Attendance will be taken and factored into grades.
## Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic(s)</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to the Course and Overview</td>
<td></td>
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</tbody>
</table>
| 2    | Lecture/Activity on historical and societal perspective on engineering challenges  
A. Asia and Middle East |  |
| 3    | Lecture/Activity on historical and societal perspective on engineering challenges  
B. Europe |  |
| 4    | Lecture/Activity on historical and societal perspective on engineering challenges  
C. Americas |  |
| 5    | Lecture/activity on Grand Challenges for the 21st century  
A1. Energy-related Challenges |  |
| 6    | Lecture/activity on Grand Challenges for the 21st century  
A2. Energy-related Challenges |  |
| 7    | Lecture/activity on Grand Challenges for the 21st century  
B1. Environment-related Challenges |  |
| 8    | Lecture/activity on Grand Challenges for the 21st century  
B2. Environment-related Challenges |  |
| 9    | Introduction to Grand Challenge Projects  
Research Methods, Global resolve, Service learning, Entrepreneurship, Resources - FURI, Internships, EPICS |  |
| 10   | Lecture/activity on Grand Challenges for the 21st century  
C1. Health-related Challenges |  |
| 11   | Lecture/activity on Grand Challenges for the 21st century  
C2. Health-related Challenges |  |
| 12   | Lecture/activity on Grand Challenges for the 21st century  
D1. Security-related Challenges |  |
| 13   | Lecture/activity on Grand Challenges for the 21st century  
D2. Security-related Challenges |  |
| 14   | Comparative study of the approaches of G7, G-20 and BRIC countries to the Grand Challenges |  |
| 15   | Consequences of the grand challenges on economic, technological, political, and cultural fabric of society |  |
| 16   | Grand Challenge Project Presentations |  |
Plan B 4.0: Mobilizing to Save Civilization
Lester R. Brown

Table of Contents

Includes Podcasts of Preface and chapter introductions.

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<tr>
<th>Entire book (pdf)</th>
<th>Data sets</th>
</tr>
</thead>
</table>

**Preface** (pdf) (Listen to Audio)

1. **Selling Our Future** (pdf)
   - Introduction (Listen to Audio)
   - Food: The Weak Link
   - The Emerging Politics of Food Scarcity
   - Our Global Ponzi Economy
   - Mounting Stresses, Failing States
   - Plan B—A Plan to Save Civilization
   - Chapter 1 Data (xls) (pdf) (highlights)

**PART I. THE CHALLENGES**

2. **Population Pressure: Land and Water** (pdf)
   - Introduction (Listen to Audio)
   - Civilization’s Foundation Eroding
   - Water Tables Falling
   - Farmers Losing Water to Cities
   - Land and Water Conflicts
   - Cars and People Compete for Grain
   - The Rising Tide of Environmental Refugees
   - Chapter 2 Data (xls) (pdf) (highlights)

3. **Climate Change and the Energy Transition** (pdf)
   - Introduction (Listen to Audio)
   - Rising Temperature and Its Effects
   - Melting Ice, Rising Seas
   - Melting Glaciers, Shrinking Harvests
   - Rising Temperatures, Falling Yields
   - The Decline of Oil and Coal
   - A Challenge Without Precedent
   - Chapter 3 Data (xls) (pdf)

**PART II. THE RESPONSE**

4. **Stabilizing Climate: An Energy Efficiency Revolution** (pdf)
   - Introduction (Listen to Audio)
   - A Revolution in Lighting Technology
   - Energy-Efficient Appliances
   - Zero-Carbon Buildings
   - Electrifying the Transport System
   - A New Materials Economy
   - Smarter Grids, Appliances, and Consumers
   - The Energy Savings Potential
   - Chapters 4 and 5 Data (xls) (pdf)

5. **Designing Cities for People** (pdf)
   - Introduction (Listen to Audio)
   - The Ecology of Cities
   - Redesigning Urban Transport
   - The Return of Bicycles
   - Reducing Urban Water Use
   - Farming in the City
   - Upgrading Squatter Settlements
   - Cities for People
   - Chapter 6 Data (xls) (pdf) (highlights)

6. **Eradicating Poverty and Stabilizing Population** (pdf)
   - Introduction (Listen to Audio)
   - Educating Everyone
   - Toward a Healthy Future
   - Stabilizing Population
   - Rescuing Failing States
   - A Poverty Eradication Agenda and Budget
   - Chapter 7 Data (xls) (pdf) (highlights)

7. **Restoring the Earth** (pdf)
   - Introduction (Listen to Audio)
   - Protecting and Restoring Forests
   - Planting Trees to Sequester Carbon
   - Conserving and Rebuilding Soils
   - Regenerating Fisheries
   - Protecting Plant and Animal Diversity
   - The Earth Restoration Budget
   - Chapter 8 Data (xls) (pdf)

8. **Feeding 8 Billion People Well** (pdf)
   - Introduction (Listen to Audio)
   - Raising Land Productivity
   - Raising Water Productivity
   - Producing Protein More Efficiently
   - The Localization of Agriculture
   - Strategic Reductions in Demand
   - Action on Many Fronts
   - Chapter 9 Data (xls) (pdf) (highlights)

**PART III: THE GREAT MOBILIZATION**

9. **Can We Mobilize Fast Enough?** (pdf)
   - Introduction (Listen to Audio)
   - Shifting Taxes and Subsidies
   - Coal: The Beginning of the End
   - Climate Stabilization Steps