

GT1201 Exploring Grand Challenges

Course Proposal Notes

Attached is a proposal to the Institute Undergraduate Curriculum Committee for a permanent course listing for the Exploring Grand Challenges course.

This course is a required course for participants in the Grand Challenges Living Learning community, and is offered each Spring.

We are requesting that:

- 1) This course receive a GT course listing designation; and
- 2) that this course be listed as a 3-0-3 course for credit.

1. GT Listing

This course has participants from all majors. It is both inappropriate as well as confusing to list this course through a single academic unit. We taught this course as BMED 1803 this past Spring due to immediacy and the need for a listing. Such a listing confused the students and also imposed a burden on the School of BME.

2. 3-0-3 credit

This course uses a problem-based learning approach. The students meet 3 days a week at the same hour. In a typical week, one day is devoted to lecture and/or class-wide discussion, while the other two days the students meet with their facilitator, with a typical ratio of 8 students per facilitated group. Georgia Tech does not have a designation for such facilitation, but we believe the nature of the facilitated activities is more appropriate to the credit given to a lecture, rather than comparing such facilitation to a recitation or a laboratory exercise. On the course proposal form we have listed this course as 33% lecture and 67% discussion.

FACULTY: Dr. Robert Butera (Course director), Dr. Wes Wynens (co-director), others

PREREQUISITE: Permit by instructor and participation in the Grand Challenges Living Learning Community
CREDIT: 3 (3-0-3)

Format: MWF for an hour each time. Monday is a lecture, while Monday and Wednesday are 1 hour small group recitation sections led by a trained facilitator. Due to the nature of a problem-based learning course, it is expected that students will meet outside the classroom for at least 3 hours/week as well.

SYLLABUS

DESCRIPTION: Grand challenges facing society require multidisciplinary solutions. Ideal solutions are not solely technological, but require scientific advances, economic considerations, and policy perspectives. Such challenges include pressing needs including healthcare, food and water resources, and meeting global energy needs.

How do we solve such problems requiring a range of understandings and considerations? How do different classes of professionals (the engineer, scientist, business leader, policy professional, doctor, lawyer, community activist, non-governmental organization advocate) bring their skills to such problems? How are such efforts developed and managed?

How is a team essential in tackling such problems? What kinds of activities are critical in moving from a problem statement to a technical report on a proposed solution? What is the role of iteration in the problem scoping process? In this introductory course, you will have the opportunity to 1) rise to such pressing challenges by tackling two different but current global problems and 2) finish the semester by pitching a grand challenge proposal to be conducted during the following summer or academic year. Some of these proposals will be selected for funding during your sophomore year!

For all of the posed problems, you will accomplish this with other team members and a facilitator who will guide the problem solving process without giving you answers. You will need this team because the problems are complex enough to need many minds and hands to reach a solution in a short amount of time. To be successful in this course, you will become a self-directed learner eager to extend your knowledge through systematic inquiry. You will spend time out of class finding the most reliable, up-to-date and relevant information needed to solve the problem. You will critique yourself and others. The problems are designed to help you deepen and broaden your conceptual base in a broad base of disciplines, while enhancing your interest in your own chosen discipline. You will need to work on your team skills through developing communication and interpersonal capabilities.

DESIRED COURSE OUTCOMES: By the end of the course, you:

- will develop an understanding of the need for multi-disciplinary approaches to humanity's pressing issues;
- will meaningfully consider the role of various stakeholders in implementing solutions;
- will recognize that global problems have local solutions, whose implementation is uniquely determined by local resources that can be quite different from locale to locale;
- will learn about the complexity of large messy problems; how to ask the right questions, how to divide problems into their constituent parts without losing sight of the context, and how to lead and work with others in a team format;
- will possess the ability to instruct others and learn through instructing;
- will conduct independent research and thinking about grand challenges; and
- will possess the capacity to carry this learning into your future career.

COURSE MATERIALS: There are no required textbooks for this course.

GRADING

Attendance at all group sessions, presentations and lectures is essential to success in this course. If you are late by more than 15 minutes, you are considered absent. After three unexcused absences in the facilitated sessions, each additional absence will lower your grade one full letter. Failure to attend the weekly lecture will also impact your grade. Excused absences will require documentation and are expected to be provided with 24 hours notice except in exceptional circumstances.

Methods of assessment:

- *Module Deliverables:* each of the modules plus the final project has a deliverable – either a paper or a presentation (or both).
- *Final proposal:* The final proposal will be graded based on criteria to be provided when it is assigned. Criteria include Problem Identification and Justification, Scale of problem to a student project, Feasibility of proposal, Anticipated Results, Reasonableness of budget, and Assessment of outcomes.
- *Personal journal:* At several points in the semester you are expected to update a blog on T-square. This will use the Blog feature on the Grand Challenges T-square site. This blog chronicles the work you have done outside the group meetings. Every weekly update should answer the following questions or provide the following information:
 - **READING LIST:** What sources you have discovered and read?
 - **READING LIST SUMMARIES:** Write a summary paragraph (5-8 sentences) about the key findings of any sources (articles, websites, chapters, press releases) that you have read.
 - **REFLECTION:** What are you thinking about during the current project? What ideas you have thought of, what issues you are currently struggling with?
 - **GROUP PROGRESS:** How is the group dynamic going? How are you contributing? How are others contributing? What conflicts have arisen and how have they been solved?

The blog should be well organized **with titled sections for each of these categories**. Note that while this is technically a blog, we will make the default settings such that nobody can see these posts except the faculty directors.

- *Post-problem self/peer evaluation:* You will evaluate both yourself and your teammates in a face-to-face reflective session after each problem. You will identify what you/peers have done well and where improvement is required. This session is very important for you to get feedback from your peers and for you to voice opinions about the team in general and its success. This assessment is based on observations

of your work in the group meetings, the quality of your research and your team skills, your facilitator will assess you in four areas: inquiry skills, knowledge building skills, problem-solving skills and team skills. (See assessment rubric for detailed description of behaviors associated with grades in each category.) You must submit peer evaluations – if you do not submit evaluations, your peer evaluation grade will be an F!

- *Mid term facilitator meeting:* Every team will meet with his/her facilitator mid-term for an individual evaluation.

Grade Breakdown:

Module 1A paper	10%	
Module 1B presentation	10%	
Module 1B paper	10%	
Module 2 presentation	no grade – critical faculty feedback is provided after talk	
Grand Challenge Problem ID Paper	10%	
Grand Challenge Presentation	10%	
Grand Challenge Paper	20%	Assignment Total: 70%

Personal Journal 10%

Facilitator Evaluation 20%

GRADING SCHEME: Each assignment is ultimately reported on a 4 point A-F scale. **A:** Superior effort and quality of work. **B:** solid effort and a reasonable quality solution that meets the objectives of the assignment. The student has a solid understanding of the learning objectives of the assignment. **C:** work that is marginally sufficient to meet the assignment requirements. Core concepts were addressed, but not thoroughly, and/or minor misunderstandings are evident. **D:** Critical flaws in reasoning or understanding, submitted work represents little more than an attempt to turn something **F:** a complete lack of understanding or effort. Assignment specific rubrics are provided with returned grades for each assignment explaining what each letter grade means.

LEARNING THROUGH FAILURE: A component of problem-based learning is improving by feedback. This means “flailing in the wind” at the start, and some groups wind up with relatively low score on initial assignments. *The 70% assignment total will be the greater of 1) the assignments listed above or 2) the weighted score of the presentation and paper.*

PEER EVALUATIONS AFFECT YOUR GRADE: You may note that all of the modules and final proposal are team based assignments. Peer evaluations are performed after every assignment. Students with average peer evaluations receive the team grade. Those with higher or lower peer evaluations will receive a final grade that is mathematically adjusted up or down based on those evaluations based on the difference between the individual’s average peer evaluation and the average peer evaluations for the entire team.

HONOR CODE: In this course plagiarism is the most likely source of Student Honor Code violations. Students are cautioned to be mindful that the submission of material wholly or substantially identical to material created or published by another person without adequate credit notations indicating authorship constitutes plagiarism. When referring to the work of others use proper citation in presentations and reports. All students suspected of academic misconduct will be reported to the Office of the Dean of Students.

EXPLORING GRAND CHALLENGES – SAMPLE CLASS CALENDAR FROM SPRING 2013

As a demonstration – this is the class calendar from Spring 2013.

M Jan 7: Class Intro, What is a Grand Challenge? What did Wes mean by “wicked problems?” Characteristics?

W Jan 9: How to estimate anything.

F Jan 11: Meet your facilitator, deciding ground rules and processes for group discussions, and intro of Module 1A.

M Jan 14: Module 1A: Water. Day 1: initial brainstorm.

W Jan 16: Module 1A: Water. Day 2: critique and revise.

W Jan 16 PM Module 1A paper due

F Jan 18: Group Critique – each group looks at all the papers and evaluates the quality of each estimate.

F Jan 18 1159pm – Personal Journal Entry 1 Due

M Jan 21: NO CLASS – MLK DAY

W Jan 23: Library lecture – finding data, facts, figures from non-peer-reviewed sources

W Jan 23 PM- Module 1A revision due

F Jan 25: Library lecture – finding peer-reviewed information in the scientific literature

M Jan 28: Module 1B. Less water! Well-defined problem, many solutions.

W Jan 30: Module 1B day 2.

F Feb 1: Module 1B day 3.
Presentations uploaded by Sunday night, Feb 3!

Sun Feb 3 1159pm – Upload presentation

M Feb 4: presentations by 4-5 groups. 5 minutes talk, 5 minutes discuss.

W Feb 6: presentations by 4-5 groups. 5 minutes talk, 5 minutes discuss.

F Feb 8: In Person Peer Feedback Discussion. Use Team Member Evaluation Form.

Sun Feb 10 1159pm – Personal Journal Entry 2 Due

M Feb 11: Module 2 – Scoping the Problem Space

W Feb 13: Module 2 day 2.

F Feb 15: : Dr. Ellen Zegura – computing for good.

M Feb 18: Module 3 day 3.

W Feb 20: Module 3 day 4.

F Feb 22: **Lecture/visitor TBD**

M Feb 25: Module 2 presentations

W Feb 27: Module 2 presentations

F Mar 1: Module 2 presentations

Sun Mar 3 1159p – Personal Journal Entry 3 Due.

M Mar 4: Grand Challenge Assigned.

W Mar 6: Grand Challenge part 1 work.

F Mar 8: Lecture/visitor : Dr. Leroy Emkin. Computers and Engineering Design.

M Mar 11: Grand Challenge part 1 work.

W Mar 13: Grand Challenge part 1 work.

F Mar 15: Lecture/visitor. Southface Institute.

M Mar 18-F Mar 22. SPRING BREAK.

M Mar 25: Feedback on problem identification. Meet in lecture.

W Mar 27: Work on GC proposal.

F Mar 29: Speaker – Travis Horseley on TOHL.

MWF Apr 1,3,5 – work on proposal

MWF Apr 8,10,12 – work on proposal

MWF Apr 15 – GC PROPOSAL WEEK – Oral presentations.

MWF Apr 22,24,26 – Week for group-specific project feedback

Thur Apr 18 1159p – Personal Journal Entry 4 Due.