

# CSE Curriculum Committee

Agenda Summary  
September 20, 2011

Full agenda is on the web site: <http://www.aem.umn.edu/~shield/csecc/>

1. Approval of April 19 2011 meeting Minutes – see web site.
2. Meeting Schedule for Fall 2011 and Spring 2012
  - a. Tuesday December 6, 2011 at 2:30
  - b. Tuesday January 31, 2012 at 2:30
  - c. Tuesday April 17, 2012 at 2:30
3. Items for Information only (already approved in ECAS):
  - a. See web site
4. Items for Approval without Objection (already approved in ECAS):
  - a. BBE 4001 – Chemistry of Plant Materials: update to description and title
  - b. BBE 4733 – Renewable Energy Technologies: Update to description, add TS theme
  - c. BBE 5001 – Chemistry of Plant Materials: Update to description and title, change to GRAD career
  - d. BBE 5733 – Renewable Energy Technologies: update to description, change to GRAD career
  - e. BMEN 5351 – Cell Engineering: changes to prerequisites: remove CSCI 1107 add BMEN 2401
  - f. CHEM 4601 – Green Chemistry: added prerequisites: CHEM 2302 and 4501 and removed chemistry senior
  - g. CSCI 1001 – Overview of Computer Science: add prerequisites: non-CSci/CompE major
  - h. CSE 1001H – First Year Experience: Add honors version of this course.
  - i. HSCI 3421 – Engineering Ethics: updates to description and renumber from 3420. Add HIS core and CIV theme.
  - j. MATH 4065 – Theory of Interest: increase to 4 credits and expand description.
  - k. PHYS 4303 – Waves, Optics and Relativity rename to Optics and Acoustics. And update to description.
  - l. SENG 5707 – Database Systems: Rename to Data Modeling and update description.
5. Action Items (new course syllabi are below or separate handouts):
  - a. New Course: BMEN 5412 – Neuromodulation (see handout)
  - b. New Course: BMEN 5413 -- Neural Prosthetics (see handout)

c. Chemistry Course Changes:

- i. CHEM 1021, 1022, 1031H, 1032H remove lab component, reduce from 4 to 3 credits
- ii. New Courses: CHEM 1025, 1026, 1035H, 1036H – 1 credit labs (see CHEM 1025 syllabus below as an example)

**iii. NOTE: Any programs that require these courses will need to update PCAS by October 31.**

- d. New Course: MATH 4001 – Actuarial Mathematics in Practice (see handout)
- e. New Course: MOT 5224 – Introduction to Technological Leadership and Management: Assessing Emerging and Pivotal Technologies (see below)

6. New Business

- a. **Change to CSE Constitution:** See handout for changes to this committee's charge to also cover graduate courses. My comments on this were:
  - i. II.2.1 You might also want the Associate Dean for graduate programs (if there is to be such a position) to also be ex-officio. Or you could change it to "Associate deans, as appointed by the Dean to this committee, are ex-officio non-voting members of the committee." And leave yourself free to work it out.
  - ii. II.2.3 The reports to the committee are just PCAS printouts that I put on the web site, so there is very little overhead. Thus I would strike UG in this as well. (I assume grad programs are now in PCAS as well.)

7. Adjourn

## New Courses Syllabi

### CHEM 1025

Course Title Long: Chemical Principles I Laboratory

Max-Min Credits for Course: 1.0 to 1.0 credit(s)

Catalog Description: Students will gain essential basic laboratory skills while investigating physical and chemical phenomena closely linked to lecture material. Students will gain experience in experimental design (for example, considering chemical limitations in selecting chemicals for use in various experiments), data collection and treatment (graphing, calculations, interpretation), discussion of errors, and the proper treatment of hazardous wastes.

Course Prerequisites for Catalog: &1021

#### Course Materials

"Cooperative Chemistry Laboratory Manual", 5th edition by Melanie Cooper

"General Chemistry 1021/1022 Laboratory Notebook" (special duplicating paper - found in campus bookstore).

Goggles: Approved splashproof goggles will be provided on the first day of lab.

#### Grading & Missed/Late Work Policies

##### Grades

Your laboratory grade will be based on the average percentage of your lab work as shown in the breakdown below. Your lab score will be forwarded to your lecture instructor. Twenty percent of your final course grade will depend upon your laboratory performance.

See the lab website for details on the graded items shown below. You will find detailed grading rubrics that describe the expectations for each item.

Your TA should post your grades one week after you turn in your work. If you do not see your grade posted, please discuss this with your TA immediately and notify the instructor if the situation is not rectified. Any grade disputes should be taken up directly with your TA and advanced to the instructor if not resolved. Grade disputes must be lodged with the instructor prior to the last week of lab in order to gain full consideration.

The lab F is reserved for those students who fail the course because they failed to complete the experiment and turn in the completed lab work for 3 or more days (3 or more zeros or incomplete work). In other words, if you fail to 1) attend lab and/or 2) attempt & complete the entire lab work (and hand it in on time), in any combination, three times or more, you will fail lab!

Project	1	5	11	12	Dye*	Misc		
Summary & Pre-lab (Group Grade)					15	25	40	25 20
Draft of Report (Individual Grade)						10		

Final Report (Individual Grade)						100
Technique & Lab Notebook (Individual Grade)	10	20	30	20	20	
Oral Report/Poster (Group Grade)	15	25	15	15		
Peer Evaluation (Individual Grade)	15	20	15	15		
Overall Safety (Individual Grade)				30		
Lab Surveys (Individual Grade)				10		
Total Points	25	75	225	75	70	40

\*It is possible that there will not be enough time during the summer semester to complete the Food Dye project. If that is the case, these points will not be included in the determination of your final lab percentage.

#### CHEM 1021 Lab Schedule - Summer 2011

Session	Date	Experiment	What's Due?
1	Monday June 13	Lab Syllabus, Expectations, Use & Care of Balances, Safety Formation of Lab Teams	Plan Project 1: Density Safety Contract (online)& Project 1 Plan
2	Wednesday June 15	Project 1: Density	Plan Project 5: Designing a Calcium Supplement Project 1 Summary Questions & Project 5 Plan
3	Monday June 20	Project 5: Designing a Calcium Supplement	Project 5 Summary
4	Wednesday June 22	Project 5: Designing a Calcium Supplement	Project 5 summary
5	Monday June 27	Project 5 Oral Reports	Plan Project 12: Hot & Cold Project 5 Presentation & Project 12 Plan
6	Wednesday June 29	Project 12: Hot & Cold	Project 12 Summary
7	Monday July 4	NO LAB - HOLIDAY	
8	Wednesday July 6	Project 12: Hot & Cold	Project 12 Summary
9	Monday July 11	Project 12 Oral Report	Plan Project 11: Ionic Compound Project 12 Presentation & Project 11 Plan
10	Wednesday July 13	Project 11: Ionic Compound	Project 11 Summary
11	Monday July 18	Project 11: Ionic Compound	Project 11 Summary
12	Wednesday July 20	Project 11: Ionic Compound	Project 11 Summary
13	Monday July 25	Project 11 Presentations	Plan Food Dye Project Project 11 Draft Report, Presentation, & Food Dye Project Plan
14	Wednesday July 27	Food Dye Project	Food Dye Summary
15	Monday August 1	Food Dye Project	Project 11 Final Report & Food Dye
16	Wednesday August 3	Food Dye Oral Report	
TA & Course Evals		Food Dye Presentation	

**MOT 5224 Introduction to Technological Leadership & Management: Assessing Emerging & Pivotal Technologies**

Course Title Long: Introduction to Technological Leadership and Management: Assessing Emerging and Pivotal Technologies

Max-Min Credits for Course: 1.0 to 1.0 credit(s)

Catalog Description: The course requires 4 mandatory attendances. Two in person and two on-line. The two in-person mandatory classes will take place on 9/9 and 12/1 (1:30-4:30 pm) & the two on-line mandatory classes will be on 10/14 (1-3pm) and 10/28 (10-noon). The focus is on selected emerging technologies that are expected to play key roles in future industrial development. (1 credit)

(No prerequisites)

**COURSE OBJECTIVES**

Develops an understanding of the fundamentals of management of technology with a focus on selected technologies, including energy, security and nanotechnology, expected to play pivotal roles in future industrial development. Current state-of-the-art status for each technology, together with barriers and opportunities for commercialization will be addressed.

Discussions by two guest experts and student group analyses of potential applications of the technologies to industry will be conducted. More specifically we shall investigate selected pivotal technologies from energy (generation and transmission), security (critical infrastructure protection and sensor networks), and nanotechnology.

Security challenges of protecting critical infrastructure in the United States have been highlighted during the last two decades. In the aftermath of the tragic events of September 11th, our critical infrastructures are facing new scrutiny. Virtually every crucial economic and social function depends on the secure and reliable operation of our national infrastructures. Critical infrastructures such as electric power, oil/gas/water pipelines, transportation, and telecommunications networks including the Internet and digital systems become increasingly interdependent, critical and complex. From an asset management and strategic R & D viewpoint, the security, agility and robustness/survivability of large-scale critical infrastructure that face new threats and unanticipated conditions will be presented.

We will draw upon the technological innovations, fields of systems risk analysis, engineering, and economics to investigate infrastructure security, and to support design and management of complex infrastructure systems today and through the full life cycle. This course reviews and builds upon strategic technology assessment, technology foresight and forecasting, energy systems, sensor networks, critical infrastructure, systems vulnerability assessment, asset and risk management, investigation of infrastructure interdependencies and couplings, along with judicious analyses of pertinent technologies coupled with potential for market impact, and their contribution to strategically enhance our security and quality of life.

This course has also been designed to serve as a bridge between introduction to MOT, pivotal and emerging technologies, technology assessment, foresight and forecasting, S&T policy, and the strategic management of technology. Reading all of the references will be overwhelming to many in the class. Please decide who in your group will be reading which ones ("divide and conquer") and read the subset that is of most interest to you individually (say about 20%-25% per student). The faculty members provide summaries and discuss selections from the reading list together in class.

#### Supplementary Books:

Cornish, Edward, *Futuring- The Exploration of the Future*, World Future Society (2004).

Arthur, W. Brian, *The Nature of Technology*, Free Press (2009). (This text will also be used in MOT 8232 Innovation in the 2011 Spring semester.)

#### Articles:

- Albright, Richard, "The Process: How to use roadmapping for global platform products" *Visions Magazine*, Oct. 2002.
- Brin, David, "Prediction a Faith, Prediction as a Tool: Peering into Tomorrow's World," *Futures Research Quarterly*, Summer 2006, pp. 16-24
- Coates, Joseph, "Normative Forecasting," in *Futures Research Methodology*, v. 2, edited by Jerome Glenn
- Coates, Joseph, "Why Study the Future?" *Research Technology Management*, May-June 2003.
- Coates, Joseph, "Scenario Planning," *Technological Forecasting and Social Change* 65, 115-123 (2000).
- Kostoff, Ronald and Schaller, Robert, "Science and Technology Roadmaps," *IEEE Trans. On Eng. Mgmt.*, 48, p. 132 (May 2001).
- Popper, Steven, et al., "Shaping the Future," *Scientific American*, p.66, April 2005
- *Innovation, the attackers advantage* - Richard N Foster . Summit Books. 1986
- *Technology in the National Interest* - National Science and Technology Council. OSTP 1994. Washington DC 50502
- *Managing R&D as a Strategic Option* - G.R.Mitchell ,W.F.Hamilton. *Research Technology Management*. May/June 1998
- *A Perspective on Entrepreneurship* - Stevenson, Howard H. Harvard Business School, case 384-1 3. 1983
- The following supplementary Internet resources are also recommended:
- [www.battelle.org/aboutus/rd/2011.pdf](http://www.battelle.org/aboutus/rd/2011.pdf)
- *Energy, Materials/Nanotech, Security/Communications, and Biomedicine:* <http://www.technologyreview.com>
- For a related discussion of a subset of exciting Emerging Technologies please see the May 2005 issue of MIT Technology Review. For details on each please search subject word: Airborne Networks, Quantum Wires ,Silicon Photonics, Metabolomics, Magnetic-Resonance Force Microscopy, Universal Memory, Bacterial Factories, Enviromatics, Cell-Phone Viruses, Biomechatronics

- In addition, please search your pertinent areas of interest in the development, application and use of distributed sensor technologies in the management, monitoring, and maintenance of infrastructure systems. Assess the state of the art on current technologies and on-going projects and assemble this information into a web page as a class project. For example, there are existing projects in use of sensor networks to monitor the quality of upstream Mississippi water and relay this information to automatically reconfigure the operation of the Minneapolis water treatment plant. RPI in New York State has had similar work on the way. We'll identify technology and business opportunities in this area.

## TECHNOLOGY EVALUATION PROCESS

This process takes a very different perspective by looking into the future (2 to 10, or even to 20 years out) in Pivotal Technology areas totally outside of the electricity and security sectors. Once the key questions and issues are defined and the scope of the process is determined, the participants are divided into study groups.

The teams then look for interactions between electricity energy service trends or CIP areas and technology dynamics to develop a portfolio of science and technology opportunities in various categories pertinent to highest societal and business impacts. The whole group then reconvenes to share, integrate, and analyze the outputs of the sector teams. These overall opportunities are then mapped against the Assets of the system (taken in the broadest sense).

The outputs of this step are then mapped back to the current technology strengths from the insight phase. This overlay yields three types of opportunities and actions:

1. Strategic enhancement of the Technology Power Zone. This extrapolates current S&T, society and business needs with incremental opportunities.
2. Extension of the Technology Power Zone. The extension builds the strategic future based on today's foundation.
3. New Pivotal Technology Opportunities. Developed within current units, this identifies new development or alliance partnering prospects not currently in the planning horizon.

## Outcomes

The expectations and anticipated outcomes of the process are to further:

Discover the pivotal science and technology strengths in the current technology profile, as they relate to future trends. The teams will identify and map those key science and technologies that are essential to the Consumer Needs, Technology Potential and Technology Scanning tracks.

Target major new growth platforms. The teams will sort existing science and technology strengths and new opportunities to characterize platforms.

Identify emerging Customer Needs and Technology development opportunities. These opportunities can be applicable to core stakeholders or involve new ventures based on science and technology strengths.

Gain insight for R&D prioritization and strategy. Prioritization is a key problem for most R&D organizations. There are always too many paths to take and jobs to do within resource allocation.

Integrate input for the strategic planning and optimization process. The results of the foresight process provide a business view of science and technology developments and opportunities that can be integrated into the strategic plan, rather than tacked on as the "contribution" from R&D.

Leverage existing technology strengths. The process can lead to clearer insight on current science and technology assets when looked at from a future perspective, rather than just incremental contributions to today's system and products.

Drive innovation through interconnecting the S&T community. By using the expertise of technical and business professionals in the process, new relationships across disciplines and businesses are created. These can be a major source of innovation for years to come. We have also seen the re-energizing of key sectors and technical personnel through participation in these activities with their peers.

In taking the lead in this endeavor, Dr. Amin will help you to identify a few (less than 10) critically important highest priority Innovation Nodes. While not an exhaustive list of the challenges that must be overcome, these are crucial to success, and thus, may ultimately become the focus of future efforts. The highest priority Nodes will create a unified picture of critical goals and challenges for meeting 21st Century service expectations. At this Residency, we shall:

1. Each study group will identify a few (2-4) key pivotal technologies per group that make the highest impact.
2. Expand the list (12+) with related technologies that drive, use, or synergize with these.
3. Map these onto the Technology Space Map
4. Circle size for Leading (large), Strong (medium), or Capable (small)
5. Shape the Technology Power Zone
6. Where do the market, policy and technology trends move the power zone in the next 2-4, 5-7, 10 or 20 years?
7. Share results with all participants.

Using examples of technology opportunities drawn directly from the energy and security sectors, study groups will be divided into parallel breakout sessions where they will systematically address each step. Specific technology areas to be addressed are tentatively planned as:

- Materials and devices including nanotechnology, microfabrication, advanced materials and smart devices
- Meso- and Micro- scale devices and sensors and networks
- Advances in information science: algorithms, AI, systems dynamics, network theory, complexity theory
- Bioinformatics, biomimetics, biomechatronics, systems biology
- Enviromatics

- Other industries— moving to a wireless world— transportation, telecommunications, digital technologies, sensing and control
- Markets, economics, policy and environment
- End-to-end Infrastructure-- from fuel supply to end use
- Other areas

#### ASSIGNMENTS and GRADING

You are free to select from a list of possible topics provided by the instructor or, with the prior consent of the instructor, to choose your own topic. Grades will be assigned based on:

- Participation in class discussions (10%)
- Each study group will prepare detailed analyses of selected pivotal technologies and their summary business cases. A brief executive summary report along with a class presentation investigating and discussing pertinent technology, potential business impact and policy issues and debates, along with your analyses and recommendations, and provide a final presentation on the technology(ies), pros/cons, cost/benefit, articulate urgent/tactical/strategic priorities, all findings and recommendations (70%).
- As always, please be mindful of balanced individual contributions and accountability; peer reviews (20%)

#### COURSE SYLLABUS AND SCHEDULE

Class Date	Time	Content
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##### Session 1:

In person at TLI 3 hours

2.5 hours:

Introduction to the course and Pivotal Technologies Overview:

Framework and Assessment Methodology

Context and case studies for energy, cyber, telecommunications and information systems, nanotechnology, and security challenges

Pivotal Technologies in energy, cyber/telecom/information systems, Nano

30 minutes: Ideation on course projects and team assignments

##### Session 2

4 hours      1 hour:

Leadership Excellence

2.5 hours: Global R&D/market dimensions: Understanding emergent and accelerated global trends/shifts in energy, education, population/workforce, R&D centers and Innovation;

30 minutes: Discussion & share results-- identify additional needs and final project preparations

##### Session 3

4 hours

45 minutes:

Project Plan Presentations (5 min. per team)

1 hour:

Understanding Local vs. Global  $\hat{\omega}$ ; Examples include China/India and global dimensions  
Scanning, Mapping and Evaluation Activity

2 Hours:

Nanotechnology continues to be a vibrant and emerging area for science, engineering, and business. Focus on basic nanotechnology principles and applications including the science of dimensional scaling (in the electrical, mechanical, optical, chemical, and biological domains); nanodevices and components; nano-materials, nanostructuring, and nanofabrication; integrated nanosystems; and considerations for interfacing nanotechnologies with the micro-, meso-, and macroscopic worlds. Several case examples in nanobiotechnology, nanoelectromechanical systems, or NEMS, and nano-optics will be presented to expose both the multi-disciplinary science of nanotechnology and considerations needed for the development of new business opportunities.

Breakout groups:

Identify Opportunities and fuse with nano, IT, and global dimensions

Discussion and Opportunities for synthesis

Identify additional needs and preparations for course projects and preparation for group presentations

#### Session 4

4 hours Workshop:

Expanding your view of the pivotal technologies, global MOT, investigating and discussing immediate to short/mid-term as well as longer-term collaboration and innovation opportunities in the above areas, along with pros/cons, associated risks, cost/benefit, and strategic/tactical/urgent issues.

Discussion & share results: Identify additional needs and final project preparations

#### Session 5

4 hours Midterm progress report group presentations with Short-term and long-term moves (20 minutes per team)

Review: Framework & Assessment Methodology, followed by Workshop:  
Opportunities for synthesis, New Product Development (NPD) and New Business development (NBD)

Recursion on identified opportunities and convergence of pivotal technology opportunities

Case studies: IT, Energy, biosciences, IP and other selected areas

Assessing opportunities in the above technological/business sectors (combined with economic, policy and cultural interests/goals)

Session 6-7

8 hours Analyzing opportunities that organizations/companies can lead as new business development or forming global alliances.

Marketing analyses-- How do the market factors look? Infrastructure for telecom. power/energy and transportation

Work force retention and escalating salaries

Cost factors vs. emphasis on expertise

Lessons learned, time lines, surprises, threats and opportunities

Blockers, Accelerators, and the Next Steps: Possible road ahead for innovations in global technology environment

Session 8

In person at TLI 3 hours Final Project Presentations report back & share results:  
20 minutes/project team

Opportunities for synthesis, next steps and wrap-up

Adjournment