Contemplative Practices for a Technological Society
Cultivating Mind Body Practices to invent our future
April 11-13, 2013

• SESSION B6: Engineering

Chair: Roop Mahajan, Mechanical Engineering, Director of ICTAS, Virginia Tech

Opening remarks: Doug Lindner

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B6: Engineering

- The session- to start a dialogue on Engineering & Mindfulness
- Outstanding panelists
- Presentation by the panelists: 10 minutes each
- Q & A & interactive discussion

"Engineering 2029 and Mindfulness: Contemplating the Engineering Curriculum"
Roop Mahajan, Hester Chair of Engineering, Director of ICTAS, Virginia Tech.

"Integrating Contemplative Practice into Engineering Education"
George Catalano, Bioengineering, State University of NY at Binghamton.

"Contemplative Practices: Changing the University of Michigan Experience"
Diann Brei, Mechanical Engineering, University of Michigan

"Mindful Multitasking"
David Levy, Information School, University of Washington
Introduction

Top Ten problems of Humanity for next 50 years

1. Energy
2. Water
3. Food
4. Environment
5. Poverty
6. Terrorism & War
7. Disease
8. Education
9. Democracy
10. Population

• Highly interconnected
• Relationships contain feedback loops
• Exhibit some features of complex systems

Richard E. Smalley, noted scientist and Nobel prize winner

Source: Energy and Nanotechnology Conference, Rice University, May 3, 2003
• Solving the most pressing problems requires
  o integration of multiple perspectives
  o Reflection on unintended consequences: Vigilance, Alertness
  o New perspective

  “Problems cannot be solved by the same level of thinking that created them” A. Einstein

• Engineers are problem solvers
  o Harness the laws of nature to do something useful for society

• In other words –As problem solvers, as engineers, we need MINDFUL Solutions
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Engineering 2029 and Mindfulness: Contemplating the Engineering Curriculum

- Why 2029?
- Why Mindfulness in Engineering?
- What is my proposal on engineering curriculum?
Why Mindfulness?

• **Mindfulness as an alert and vigilant state of mind**

• **Characteristics:**
  o openness to new information
  o Expanded perspective--an implicit awareness of more than one perspective
  o Perception of reality as is
  o More frequent Eureka moments!!
  o Outlier and yet holistic solutions—Positive Black Swans.

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**Café X, ICTAS Headquarters**

**Outlier, beyond the incremental, retrospective predictability**

**Black Swan Seminar Series**

**laser, internet, computer**

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Engineering 2029 and Mindfulness:
Contemplating the Engineering Curriculum

• How about our current engineering curriculum?
  
  o Well-designed to meet the big challenges?
  
  o Does it promote critical thinking? Innovative thinking?
  
  o Is it reflective?
  
  o Is it holistic? Is it integrative?
What am I proposing?

- A unique blend of human and social sciences, applied sciences, communication, *mindfulness* and leadership besides the required math and core mechanical courses.

- Special care has been taken to allow a student to pursue his/her interests within mechanical engineering from a broad range of technical electives and interests outside engineering using free electives.

- The curriculum has been developed in such a way so as to keep the first year of engineering common to most engineering branches. Semester 3 has only one core mechanical course; the student really delves into mechanical engineering only in semester 4.
My proposal (cont’d)

- The Spiral method of teaching has been proposed to be interwoven throughout the 4 years, wherein basics from a previous course are first revised before moving to more advanced concepts.

- Also home courses have been established for HSS 101 – Ethics, Sustainability and Mindfulness; at least one in each semester wherein the basics learnt in HSS 101 are applied to specific cases related to the course.

Mindful Engineering Curriculum
HSS 101: Ethics, Sustainability, Mindfulness, 4 credits
- Ethical issues in international context.
- Application of the principles of moral theory to such issues as the obligations of richer nations toward poorer ones, cultural and other forms of relativism, emigration and immigration, nationalism, rural versus urban divide, tolerance, intervention.
- Environmental degradation, preservation of natural diversity, and responsibilities toward future generations. Legal vs. Ethical.
- Introduction to Mindfulness

ENGE 112 – PRACTICAL SCIENCE OF THINGS – 2 credits (€ - Home Course for HSS 101)
- A practical introduction to the science and engineering of objects and phenomena in everyday life.
- The basic principles that underlie the operation common to modern devices such as roller coasters, electronic gadgets, vacuum cleaners, airplanes, bicycles, air conditioners, automobiles, and GPS systems are developed by investigating how they work.
- Concepts of design, safety, environmental impact, ethics, innovation and mindfulness reinforced
HSS102 COMPULSORY – 3 CREDITS: KNOWLEDGE AND REALITY
- Examines the questions: What is the nature of reality?
- How do I know what is real and what is misleading appearance, error, or illusion?
- What is knowledge?
- How do I find out who I am and how I relate to the world around me?
- Philosophical discourses on knowledge and reality, its impact on technology and sustainability.

HSS 201 REASON, REVOLUTION, AND DECISION MAKING (COMPULSORY): 3 CREDITS (€ - Home Course for HSS 101)
- Study of philosophical approaches to understanding and justifying modes of human reasoning both in science and everyday life.
- Nature of theory confirmation and falsification; justifying changing paradigms of human inquiry.
- Models of Decision Making.
COMM 315 LEADERSHIP, COMMUNICATION, AND PERSUASION: 2 CREDITS

- Effective Communication Skills for leaders.
- Elements of leadership.
- Learn how to analyze your audience, organize your speech and strengthen your presentation with supporting materials.
- Practice speaking with vocal variety and body language.
- Learn the effective use of visual aids and master the delicate art of handling hostile audiences.
- Art of persuasion and negotiation. Participants will select speech topics relevant to their individual needs, deliver speeches in class and have their performances critiqued by the instructor and the class. Participants will learn how to plan persuasive, multi-level presentations for specific audiences and occasions.
- Group decision making and negotiation exercises.
COMM 325 NETWORKING AND LEADERSHIP – 1 CREDIT

- Success rarely occurs in a vacuum.

- To reach your personal or professional goals, you need the assistance of others who are supportive and can help you along the way.

- While some people find it easy to network to build these helpful relationships, others are uneasy with the prospect.

- This course will blend educational awareness, humor and interactive participation to help you learn the art of networking and how to incorporate networking into everyday situations to expand not just your sphere of contacts but your chances for success.
HSS ELECTIVES:

HSS 201 MORALITY AND JUSTICE
A critical survey of theories concerning human nature, the meaningful life, and the moral evaluation of actions, persons, and institutions. Theories will be applied to such issues as abortion, justice, and moral problems faced by professionals.

HSS 211 LANGUAGE AND LOGIC
Basic concepts in logic and critical thinking: argument, validity, deduction and induction, logical form, formal and informal fallacies. Introduction to the logic of truth functions and of categorical statements. Critical analysis of arguments in ordinary language.

HSS 312 HUMAN HEALTH AND POLLUTION
An examination of major environmental pollution problems such as electromagnetic radiation, ozone layer depletion, and global warming, with a specific focus on the resulting effects on human health. Assessment of health risks in relation to the formulation of environmental and workplace regulations is also considered.

GREEN ENGINEERING / SUSTAINABILITY ELECTIVES:
- Renewable Sources and Efficient Energy Systems
  - GREEN ENGINEERING – 3 CREDITS
  - GLOBAL ENVIRONMENTAL ISSUES: 3 CREDITS
  - ENERGY FUNDAMENTALS: GLOBAL AND FUTURE PERSPECTIVES (3 credits).
  - SUSTAINABILITY AND THE BUILT ENVIRONMENT: 3 CREDITS.
Concluding remarks

- We live in an era of grand challenges and powerful converging and emerging technologies.

**Black Swan Technologies**

**Emerging Technologies**

- We need innovative and holistic solutions—the mindful solutions
- Engineers as problem solvers and technology developers must be trained in Mindfulness
- Need to redesign engineering curriculum, with upstream training in K-12.