Management Business Engineering & Transformational Change - APS1012H - Generic Syllabus - **Refer to the course web site on Quercus for the dates**

Course Outline

"Science aims to understand nature and engineering, is about creating what has never been". Theodore Von Kármán

Innovation is the transformation of knowledge into products, processes, and services and is critical to economic competitiveness, long-term productivity growth, and wealth creation. Since the beginning of the industrial revolution in the 18th century Engineers emerged as the key drivers of national and international innovation and quality of life. By the middle of the 19th century engineering began to professionalize around functional disciplines that where designed around the underlying engineering science. Currently powerful forces, including demographics, globalization, and rapidly evolving technologies are dramatically changing the nature of engineering practice demanding far broader more integrative skills than simply the mastery of scientific and technological disciplines. 21st century challenges consist of complex system problems including transportation, communication, security, aging population, energy production and distribution, environmental remediation and sustainability. The 21st century engineering profession must transition toward a model built on discovery, innovation and entrepreneurship. This will require Engineers to move beyond the traditional foundation in pure sciences, mathematics, and engineering sciences to be drivers of strategic innovation and policy formation. – **in a nutshell to *"Engineer"* strategic change.**

The *"Management of Innovation"* course will provide students with the core concepts of innovation including; strategic thinking, transformational change management, innovative enterprise design & development, and sustaining a culture of innovation. **It is not a hand's on course that allows a student to use innovation tools and techniques - APS1013 "Applying Innovation" enables this kind of learning.** This seminar style course will equip students with the knowledge and the skills to participate in innovation initiatives at strategic and operational levels. The management of innovation is interdisciplinary and multi - functional, requiring the alignment of market forces, technological systems and organizational change to improve the competitiveness and effectiveness of organizations and society. The process of innovation management is essentially generic, although organization, technological and market specific factors will constrain choices and actions. This course will incorporate both academic readings to provide the broad theory of innovation but most of the readings and discussion will be based on the instructors many years of hands on practical experience in the management of innovation in a variety of industry sectors.

There are two books for the course that will serve as common reading each week: 1) Engineering and Product Development Management – The Holistic Approach (Cambridge University Press, 2001), and 2) Sustaining Innovation Through Problem Solving (Industrial Press, New York 2008) – this book will also be the main reading for the Applying Innovation course APS1013. Full disclosure: I wrote both of these books. For each seminar students will read the common reading (in bold type) and discuss the content both online and in-class.   This is outline below by each module.

Other books that we will review are listed in the agenda for Week 1. There are no mandatory prerequisites but previous course work or experience in leadership, process management, project management, continuous improvement (six sigma, lean), strategic management, organizational change management, lean product development or operations management would be helpful.

Course Objectives

Upon course completion, the participants will be able to:
- Establish a context for Innovation and its dimensions
- Analyze the elements of Innovation management as a key organizational capability
- Explain how innovations are diffused across cultures
- Identify how to develop an innovative future state vision through systems thinking
- Develop and prepare an organization for an innovation transformation initiative
- Explain and assess a culture of innovation for readiness to change
- Identify how to overcome the barriers to innovation in organizations
- Develop the key leadership roles in managing innovation at the group/department, division, and corporate levels
- Develop an integrated enterprise approach to innovation
- Design an Innovation delivery system for various environments
- Apply process management and project management practices to product development
- Organize and develop integrated Project / Product teams (IPT's) for project execution
- Deploy and Embed an innovation process through the core culture
- Continuously assess the "As Is" business processes
- Continuously improve the As Is process through structured problem solving
- Apply the key strategies to engage the people to sustain an innovative culture
- Identify challenges in measuring and maintaining innovation performance

Course Structure and Content: Managing Innovation is divided into four themes and 12 modules:
- The first theme is establishing a context for **Innovation** that will include numerous case histories of companies managing certain types of technological change. We will discuss various kinds of innovation and innovation diffusion through the ages.
- The second theme is; **Design and Developing an Innovative Enterprise.** The sources of success for great companies lie in what they do very well. The business model that has created great success is a barrier to change, as well as a source of advantage. **Disruptive Technologies** fundamentally challenge the company's current state business model – which is why they are so disruptive. We will discuss the approach to transformational change including visioning, process management, overcoming resistance to change, systems thinking, and effective teams
- The third theme examines; **Building the Innovation Management Process**. Once we understand how to overcome the barriers to change, we must then find out how companies can organize to achieve an innovative culture. We will examine how to design an innovative process management system that allows a company to design and build products more effectively and launch new products effectively. We will examine enterprise processes in variety of industry sectors (Aerospace –Military and Commercial,

Food, Machinery, Newspapers). We will examine the integration of standard project management techniques with process management.

- The fourth theme considers; **sustaining the innovative Lean Enterprise**. Once we understand how to overcome the barriers to change, we must then find out how companies can sustain an innovative culture. We will examine how to continuously analyze and improve business processes and business models. Central to achieving this culture is to embed systematic problem solving at the heart of day-to-day operational activities.

Learning outcomes

Knowledge and Comprehension:
➢ Understand central the features of the management of innovation at the operational and strategic levels, specifically the relationships between market, technological and organizational change, and how it contributes to the competitiveness of firms.
➢ Explain the various parts of the innovation process and their interaction

Intellectual Skills (Analysis and Synthesis)
➢ Students will develop an integrated framework for strategic thinking to analyze the process of innovation in a wide range of organizational, technological and market contexts.

Practical Skills (Application and Evaluation) Students will be able:
➢ Develop the ability to identify innovation methodologies to assess and improve organizations
➢ Assess the likely success of innovation initiatives in various organizations
➢ To communicate effectively through discussion in seminars, teamwork and writing in discussion board, critiques and a project report
➢ To gather, organize and deploy evidence, data and information.
➢ To plan and carry out work independently and to be self-disciplined and self-directed.
➢ To develop the skills of insight and critical evaluation.

Course Grading: **The components of the final course grade will be tailored for 100% online, in class and 10-day intense versions**. Here is a sample grade distribution:

Final Team Report	30%
Individual written/verbal critical reviews	30%
Class Participation -Verbal & Online Discussions	30%
Book Review	10%

30% of the grade will be determined by Class Participation. Online students must participate in the web site discussion board each week. In-class marks will consist of 5 online discussions and remaining from discussion in the class. **A Rubric and discussion samples are available on the course web site that details best practice techniques for conducting discussions.** 30% will be determined by the final paper, 10% a book review (between 600-750 words), and 30% will be

determined by three critical reviews (3 written - 1 of the 3 includes a six minute verbal presentation). **It is absolutely essential that students have a working level ability of English – Reading, Writing and Verbal.**

Class Participation (In-Class and Online). This course will be offered both online and in-class. The course will be taught through a combination of lectures (40-50 minutes), critical review presentations, in-class and online discussion. Because of this style of teaching, **regular class attendance is mandatory for in-class students – please don't underestimate this requirement your learning experience will - be enhanced through participation and teamwork**. I understand, though, that occasions do arise where you have to miss a class. Therefore, I will allow each student *one unexcused absence without any penalty*. Beyond that, any further absences (other than due to illness or family emergencies) will negatively impact your participation rating. So if you expect to be missing lots of classes, this is NOT the class for you. In all cases, I greatly appreciate advanced notice if you will not be in class. Showing up is necessary but not sufficient, however, to achieve success in the class preparation for interaction in each class is vital.

Important Expectations of Online Students. Online learning is not home study. It requires equal effort to in class learning – the advantage being – you get to engage in the learning experience at a time you choose. The academic rigor and learning outcomes are identical to an in class experience. **The online course will be administered through the university learning management system (blackboard) therefore it is important to master the use of this system**. There are some baseline rules that online learning requires. Students:

- ➢ Must commit and engage in online discussion from the end of the first week. Marks for online discussions are evenly distributed over the 12 modules therefore a maximum of 2.5 points can be gained from each discussion. The 10 best marks will be chosen.
- ➢ Must read and understand the student performance evaluation rubric available on the course web site and demonstrate this by discussing how it works in the discussion board by the end of the 2nd week.
- ➢ Should provide a 2-minute background introduction video and write up by the end of the 2nd week.
- ➢ Will be expected to produce 2 videos - 1 for verbal critical review presentations and 1 final project team presentation.
- ➢ Understand a lack of engagement in the discussion board evenly paced throughout the course will result in penalties from a grade viewpoint. Each lecture will be posted for 2 full weeks and shut off permanently after 2 weeks. You will always be able to view discussions and lectures.

Critical Review Papers. There are a total of 3 critical review readings required from each student. Critical reviews will be written papers (650 – 800 words) and one will be a written plus 6-minute verbal presentation (video for online students). Critical reviews will ideally consist of readings from each theme. There are lots of choices for the critical reviews as follows; the **"*Product Development Management Association*"** handbook (available electronically), book **"*Permanent Innovation*"** by Langdon Morris (available electronically - uploaded onto blackboard). The remainder of the critical review readings can be from scholarly papers listed

on the course web site – there are lots of choices. It is important that you think critically – what are the benefits and pitfalls of the author's views. Reviews must be sent to all class participants by email 6 PM on the night before they are due. For in-class students - **A hard copy must be given to me on the day they are due.**

Final Paper - Project Report. Students will form into teams. Teams will form around project topics. A list of topics will be provided by week 2 and teams should be formed by week 4 or 5. **Project teams will consist of separate Online and Inclass** . For the final paper you are free to select a topic in innovation that interests you. The goal of the final project report is <u>not</u> to do original field research, but to demonstrate to me your ability to apply innovation concepts *in a situation of your choosing*. The final report should be double-spaced, 12 point font, **(**approximately 2500 - 4000 words per student**).** Timing is very important to Managing Innovation! **A hard copy and a soft copy of the paper** (Adobe Acrobat PDF) must be delivered electronically no later than **20th December at 4pm -** the hard copy to be given to the mechanical & industrial engineering graduate office

Please note: for guidance purposes - project executive summaries of the team project reports from 2010 to today are available on the course web site – under important documents.

Office Hours. Because I am part time faculty it will be difficult to meet all of you individually in a timely manner because of the class size but I will endeavor to meet you in person and to answer email queries.

Important Milestones – Refer to Quercus for Dates :
  ➢ First Seminar: Orientation – Overview, Planning, and Reading Assignments
  ➢ Final date to **add** full-year and September session courses
  ➢ **No Classes**; Thanksgiving Holiday and Reading / Project Week
  ➢ Final date to drop September session courses without academic penalty
  ➢ Last Seminar and submission of Book Review
  ➢ Submission of final report
  ➢ All coursework grades submitted

Part I – Innovation in Context

Week 1 – Mod 1: Orientation, instructor background, syllabus overview, & assignments

  ➢ Overview of the entire course
  ➢ Grading structure (Critical Reviews, Book Review, Discussions, Projects)
  ➢ Web site layout and operation
  ➢ Project team formation and operation – Review past projects
  ➢ Critical Thinking and Performance Rubric
  ➢ Course Value in Career Planning – Levels of Management Thinking

Week 2 – Mod 2: Dimensions of Innovation

  ➢ Global market trends
  ➢ Sources of Innovation (internal and external)
  ➢ Types of innovation – product, process, organizational, and business model

➢ Innovation environments – manufacturing, service, public sector
➢ Degrees of Innovation Disruptive, Radical, incremental

Case Study Options: Companies; Google, Apple, IBM. Industries; Aerospace, Electronics, Computers

<u>**Week 3**</u> – Mod 3: Diffusion of Innovation

➢ Introduction to Social Evolution and Innovation
➢ Introduction to the History of Engineering and societal impact
➢ Diffusion of Innovation theory

Case Study Options: Companies; McAir to BAE Systems & deHavilland to Bombardier (Shorts, Canadair, Lear) & Messier Dowty, and then Lockheed.

Part 2 – Developing an Innovative Enterprise

<u>**Week 4:**</u> - Mod 4: Designing and developing an Innovative Lean Enterprise through Business Transformation **(Common Reading - Sustaining: Chapter 1,2)**

➢ What is transformational change?
➢ What is an Innovative Enterprise?
➢ How do we design and develop it?
▪ Directional planning and future state visioning
▪ Business process Analysis
▪ Business process design and infrastructure alignment

Case Study Options: Companies; deHavilland, Lockheed, Bombardier, MCAIR, Messier, Gaylea, BAE Systems, Samco, Boeing, Globe & Mail, Winnipeg Free Press. **Industries;** Aerospace, Defence, Food, Industrial Equipment

<u>NO Class During Reading Week– Use to Work on Final Report – I am available online</u>

<u>Week 5</u> –Mod 5: Organizational Approach to Cultural Transformation **(Common Reading - Sustaining: Chapter 3)**

➢ Building an innovative culture
➢ Motivating teams and individuals
➢ Recognizing and overcoming systemic barriers
➢ Understanding organizational politics
➢ Fostering organizational learning
➢ Roles and responsibilities in a transformation project

Part 3 – Building the Lean Innovation Management Process

<u>**Week 6**</u> – Mod 6: Enterprise Integration and Process Management   **Common Reading - Eng & Product: Chapters 1,2,3)**

➢ Enterprise wide process modeling and the supply chain
➢ New product development in various environments – the use of the stage gate method

> ➢ Systems engineering approach applied to enterprise process integration
> ➢ Process and workflow analysis
> ➢ Design and Systems thinking

Week 7 – Mod 7: Integrating Process, Project, Programme Management & IPT's
(Common Reading - Eng & Product Chapters 4, 5,6)

> ➢ Roles and responsibilities in a process driven enterprise
> ➢ Programme and Project Management in a Process Driven Enterprise
> ➢ Concurrent engineering and collaborative product development concepts
> ➢ Effective Integrated Project team (IPT's)

Week 8 – Mod 8: Lean Product Development and Knowledge Management **(Common Reading - Eng & Product Chapters 7,8,9,10,11)**

> ➢ Deliverables Architecture and Knowledge Management
> ➢ Rules and Set based Product Development
> ➢ Programme structuring and planning
> ➢ Risk management
> ➢ Project initiation and execution
> ➢ Engineering change and programmed reviews

Week 9 – Mod 9: Deploying and embedding the innovation process **(Common Reading - Eng & Product Chapters 12, 13)**

> ➢ Management of Change
> ➢ Organizing for deployment
> ➢ Overcoming resistance to change
> ➢ Role of an external management consultant as facilitator, coach and change agent

Part 4 - Sustaining the Innovative Lean Enterprise

Week 10 – Mod 10: Continuous Analyses of the "As Is" / "To Be" Business Process
(Common Reading - Sustaining Chapter 4)

> ➢ Researching customer needs
> ➢ Selecting and Prioritizing Issues
> ➢ Defining / designing Processes – Value Stream Mapping
> ➢ Establishing standards and performance measures
> ➢ Setting objectives for improvement

Week 11 – Mod 11: Continuous Improvement through Structured Problem Solving **(Common Reading - Sustaining Chapter 5)**

> ➢ Problem Identification
> ➢ Root Cause analysis
> ➢ Data gathering an root cause analysis
> ➢ Problem Solving Tools and Techniques
> ➢ Formulating and selecting alternative solutions

➢ Documentation and implementation

<u>**Week 12**</u> – <u>Mod 12: Maintaining an Innovative Culture</u> **(Common Reading - Sustaining Chapters 6, 7, Afterword)** <u>Also Final Draft Report Team Presentation</u>

➢ Learning Organization
➢ The Organization as a Living System
➢ Mechanics of effective teams
➢ Effective meetings
➢ Facilitator's role
➢ Integrated thinking
➢ Finding a higher purpose

Advanced Modules – more in depth specialist subjects

Module 13 - Product Innovation Management

Module 14 - Final Team Project Management and Development

Module 15 - Innovation Dynamics and Industrial Change

Module 17 - Knowledge Management

Module 18 - Leadership and Management for Innovation

Module 19 - Product Lifecycle Management

Module 20 - Business Process Management and Innovation

Module 21 - Fuzzy Front End and New Product Development

Module 22 - Social Evolution and Diffusion

Module 23 -Foresight Management and Development

Module 24- Innovation Drivers & Sources

Module 25-Innovation Drivers By Industry

Module 26 - Innovative Nations & National

Module 27- Innovation Gurus & Innovative Companies

Module 28 -Types of Innovation – Case Studies

Module 29-Technology Management and Innovation

Module 30 - Innovation in Consulting

Module 31 - Innovate Frameworks

Module 32 - Global Market Trends & Management of Global Change

Module 33 – Socio-Political Management