Course Overview & Learning Objectives:

COURSE DESCRIPTION

EMGT 571/671 is a four-credit class graduate-level course structured around 8 lectures, material drawn from a textbook, various publications and web-based sources, and student directed library research and class presentations. Classes may also be augmented with presentations by several outside speakers.

The course is aimed at examining the current emerging technologies projected to have a major impact on business and technology from 2015 and beyond

COURSE OBJECTIVES --

After completing the readings, lectures and assignments the student will be able to:

- Understand the dynamics of the emerging technology environment and how it can impact existing businesses and how it can lead to powerful breakthrough opportunities.
- Realize that it is crucial to maintain an active watch on fast changing industries, and establish a process for rapid integration of new, potentially disruptive technologies.
- Understand the challenges of identifying, acquiring, managing and capitalizing on emerging technologies.
- Become familiar with several specific new emerging technologies, their current state of development, and their potential applications.
Required Textbook –

**Wharton on Managing Emerging Technologies;**
Edited by Day, G.S., Shoemaker, P.J.H, Gunther, R.E.; J.W. Wiley & Sons, 2004 (Paperback)
**Publisher:** J.W. Wiley & Sons  
**ISBN:** 978-0-471-68939-3

The text should be available for purchase through the PSU Bookstore, and in electronic form for the Kindle or other text readers.

**REQUIRED READING MATERIALS –**

1. **10 Emerging Technologies 2011;** MIT Technology Review; March 12, 2011  
   http://www.technologyreview.com/tr10/
3. **A magnetic insulator transmits electrical signals via spin waves,** Mark Wilson, Physics Today, Volume 63, Number 5 (May 2011)
4. **Electronic spin memory device operates at room temperature,** R&D Magazine, April 2, 2009  
   http://www.rdmag.com/ShowPR~PUBCODE~014~ACCT~1400000101~ISSUE~0904~RETYPE~MS~PRODCODE~00000000~PRODLETTRN.html
   doi:10.1038/nmat2745 Article

**Optional Supplemental Readings –**

4. **Biological Machines: Michel Maharbiz’s novel interfaces between machines and living systems could give rise to a new generation of cyborg devices,** MIT Technology Review 2009  
   http://www.technologyreview.com/read_article.aspx?ch=specialsections&sc=tr10&id=22111
5. **Nanoneedle senses, probes, and delivers,** R&D Magazine, April 29, 2009  
   http://www.rdmag.com/ShowPR~PUBCODE~014~ACCT~1400000101~ISSUE~0904~RETYPE~MS~PRODCODE~00000000~PRODLETTHB.html

**Standards for completing Assignments –**

**Submissions** – Your completed assignments are due on Wednesday afternoon for each classroom session.

**Late Policy** – You are expected to turn in assignments on time. If you think you will be unable to complete an assignment on time, please email the professor in advance. Otherwise you will receive a grade of “0” for that assignment. As there are a limited number of class sessions and class participation is a significant portion of your grade, you are expected to attend every class. If you expect to miss more than one session, you should not take this course.
**Plagiarism** -- You should note that using information without attributing its source constitutes plagiarism. In this course, you will do research and use a variety of media to complete assignments. If material is quoted directly from any source, the source must be cited in your deliverable. (Check with the professor if you are unsure of the citation formatting or placement.) The source of non-quoted information or statistics used in support of any point must also be cited, including information from websites and other online sources. Any submission that is not properly documented will receive a grade of “0.” You are expected to express your answers to the questions in the assignments primarily in your own words. Copying text word for word as a response is simply not acceptable unless it is properly referenced, and backed up with additional interpretation in your own words.

**Preparation** -- You will be expected to prepare for class by reading the assigned materials and completing the work as assigned. Although you are expected to be familiar with all the concepts and terminology introduced in the readings, you will not be required to memorize detailed information. You must be able to intelligently discuss the patterns, concepts, strategies, etc. described in each chapter of the text. You must also be familiar with the case studies throughout the book, as well as the historical case study monographs. You are expected to listen to the lectures each week, understand the concepts that are presented and contribute to the class discussion. Material presented during the lecture parallels the text and the historical studies, but frequently contains additional material not covered in these sources.

**Written Assignments** -- There are weekly reading assignments from both the text and selected case studies. The written assignments are to be turned in at the corresponding session. In other words, the written assignments are due on Weds at the beginning of class. The assignments will be corrected and returned to you at the following session.

**Individual/Team Projects** - Individuals or teams of at most 2 students will carry out an in-depth study of one of the selected 10 emerging technologies. The team or individual will then be responsible for leading the entire class in a short presentation (~10-15 minutes) followed by a discussion on their particular technology.

**Exams** -- There will be no exams in this course.

**EVALUATION** –
The course evaluation will be determined as follows –
- 60% Individual Written Assignments
- 30% Individual/Team Class presentation and discussion on selected emerging technology
- 10% Individual Class Participation

This course is not graded according to the number of pages, the number of words, or what font you use to write your papers. The answers to some questions may only require several sentences. Other questions may require a more extensive discussion. The actual volume of words is not the issue. Your grade will reflect your ability to understand ideas and communicate them to the professor in writing, as well as your participation and ability to communicate your ideas to the rest of the class in the classroom discussions.

**Course Schedule:**

Class will be held from 1730 to 2220 on Wednesday evenings in room 106 in Stephen E. Eppler Hall on the Main Campus. There will be a 15-20 min break for dinner at around 1900.
ABOUT THE PROFESSOR –

PAUL R. NEWMAN, PH.D., Adjunct Professor, Engineering & Technology Management

Dr. Newman has over 22 years of senior management experience in high-technology companies such as Rockwell International Corporation, JBL Professional and Electro Scientific Industries. His educational background in solid-state physics has enabled him to make a number of significant technical contributions to these companies as evidenced by his 43 technical publications and 4 US patents. Over the years, his technical career evolved into one of positions of increasing management responsibility, strategic planning, and finally responsibility at the executive level. At Rockwell, Dr. Newman was promoted from Member of the Technical Staff to Group Manager, to Principal Scientist where he functioned as an internal consultant connecting the resources of the Corporate R&D Lab to the needs of the Operating Divisions. At JBL Professional, Dr. Newman was Vice President of R&D, and was responsible for launching over 30 new products, reducing product development cycle time and improving overall product quality. He was the Director of Applied Technology for Electro Scientific Industries; a position that gave him responsibility for planning both long and short term strategic R&D for the company. Currently Dr. Newman is President of Cooper Mountain Research, Inc., an independent consulting firm focused on the strategic management of science and technology. In addition to teaching at the State University of New York at Stony Brook, he also is an adjunct professor at the Department of Management in Science & Technology at the Oregon Graduate School of Science & Technology, at the Oregon Health & Sciences University in Portland, Oregon, and has taught business courses overseas in Vietnam, Korea and China. Dr. Newman obtained his BS degree in physics from Antioch College, his Doctorate in physics from Michigan State University, and did Post Doctoral work at the University of Pennsylvania’s Laboratory for the Research on the Structure of Matter.
**Unit 1 Weds June 22, 2011 – Emerging Technology—Setting the stage for exploration & acquisition**

**Learning Objectives:**
After completing this unit, you will be able to:

- Be familiar with the current top 10 remerging new technologies
- Understand the dramatic new conditions present in today’s dynamic technology based industries
- Be exposed to the management challenges posed by new fast changing and uncertain markets.
- Understand the basic concepts of disruptive emerging technologies and what benefits and threats they pose for businesses.

**Assignments to be completed before Weds, June 22, 2011. (Turn in your written homework at the beginning of class.)**

**Assigned Reading:**
1. *Managing Emerging Technologies*, Preface, Chapters 1 & 2

**Answer the Following questions based on the reading assignments:**

1. The MIT Technology Review Article is the basis for our studies of real emerging technologies. Looking at the 10 candidates proposed, at this point, which one or two do you see as having the highest potential impact in the next 5 years? (20pts)

2. Consider the chart in Fig P.1 in the preface to *Managing Emerging...* Describe in your own words what the graph purports to show. The author’s description and philosophy is not without controversy. Consider a new technology based business. Do you agree with the authors that the majority of effort is in the “technology development” phase and that it appears to drop almost to zero during the commercialization phase? Explain your reasoning (30pts)

3. On P 4 of the text, the authors describe some problems that often befuddle incumbents trying to manage technology-based businesses. Explain in your own words why these issues are problems, and what risks they pose to a new product/service. (10 pts)

4. The text refers to a number of paradoxes that must be dealt with in emerging technologies. Explain in your own words what the paradox is in terms of committing to the development of a new technology. What are the potential risks and benefits of the differing sides of the paradox? (20pts)

5. In Chapter 2 of *Emerging...* the authors refer to 4 “traps” organizations can fall into. Considering the 4th trap, explain the necessity, and dangers of persistence in pursuing a risky disruptive technology. (20pts)
Learning Objectives:

After completing this unit, you will be able to:

- Understand “speciation” as a phenomenon or divergence in the evolution of technology.
- Be familiar with changes in operation philosophy and policy needed for an organization to be successful in a technology driven marketplace.
- Be familiar with real time social networking as an information search tool.

Assigned Reading:

1. **Managing Emerging Technologies**, Chapter 3
2. Carry out some library or Internet research and identify some sources for information pertaining to “Biochemical Circuits”. A good place to start is: [Caltech Researchers Build Largest Biochemical Circuit Out of Small Synthetic DNA Molecules](http://media.caltech.edu/press_releases/13422)

Answer the Following questions based on the reading assignments:

1. Describe the impact on information storage of biochemical molecule based memory. What do you think is the future for this phenomenon? (20 pts)
2. What is meant by the term “speciation”? What is the origin and how does it apply to technology businesses? (20 pts)
3. Explain the concept of “technology convergence and fusion” and give at least 2 examples not covered in the textbook. (20 pts)
4. In the textbook, the authors make the statement “In some cases the technology never goes beyond the initial peripheral market, but ‘remains an island of application’.” Explain this statement, and why it is true. (30 pts) Extra credit (+2pts) Explain how this conforms with the “chasm” in Geoffrey Moore’s book “Crossing the Chasm.”
5. Why do the authors recommend focusing on identifying markets for a technology based product, rather than identifying products for a fixed market? (10 pts)
Unit 3 – Wednesday, July 7, 2011 --- Phase Change Memory

Assignments to be completed before today 7/7/2011

Assigned Reading:
3. Carry out some library or Internet research and investigate the “Phase Change Memory” Start with the web page at UC-San Diego “Phase Change Memory-Based "Moneta" System Points to the Future of Computer Storage” http://ucsdnews.ucsd.edu/newsrel/science/06-02-11data_frontier.asp Be prepared to discuss the subject in class.

Answer the following questions based on the reading assignments:
1. What is “Phase Change Memory” and why are its potential applications a significant impact? Who are the major players in this field? Who might be in the near future? (30 pts)
2. In Emerging Technologies, the authors cite the statement “... the competitive advantage now often goes to the companies that are most adept at choosing amongst the vast numbers of technological options and not necessarily to the companies that create them.” Explain this statement and why it is true. (20 pts)
3. The authors make the statement “The scope of technology assessment will generally be broader than the capabilities and technical assets of the firm, but it still must be bounded...” Consider the process of assessing new technology opportunities as pouring information through a funnel. Explain the author’s statement in terms of the funnel and show that the opening must not be too wide nor too narrow. (20 pts)
4. What is the definition of “emergent” as applied to technology, and what are some quantitative metrics? (30 pts)

Learning Objectives:
After completing this unit, you will be able to:

- Becomes familiar with Phase Change Memory
- Be familiar with the process of assessing new technologies
- Understand what are emerging technologies and how do you quantitatively identify them
- Comprehend the limits on the scope of technology assessment and why there are limits to how much as well as how little you should be looking at.
Learning Objectives:

After completing this unit, you will be able to:

- Be familiar with Peer-to-Peer networks, how they can be constructed, what they are used for, and what the risks are.
- Be familiar with the diffusion and adoption process in technology-based markets.
- Understand the adoption pacing characteristics of products and their markets.
- Be familiar with techniques to help the adoption of heretofore unknown “disruptive” products.

Field Trip!! Tonight’s class will start at 4pm at “Dependable Pattern Works”—737 S.E. Market St. Portland OR, 97214

Assigned Reading:

1. **Managing Emerging Technologies**, Chapter 6
2. Carry out some library or Internet research and investigate "Mobile 3D Displays." A good place to start is: Sharp Airs "No Glasses" 3D Display, Possibly Coming to Nintendo 3DS", Daily Tech Jason Mick (Blog) - April 2, 2011 http://www.dailytech.com/Sharp+Airs+No+Glasses+3D+Display+Possibly+Coming+to+Nintendo+3DS/article18040.htm Be prepared to discuss this subject in detail in class.

Answer the following questions based on the reading assignments:

1. What aspect of display technology is unique and potentially what drawbacks does this new technology eliminate? (20 pts)
2. Where is this type of research being carried out? What do you think the major impacts will be both in the military and in commercial use? Who do you think will be the eventual implementers be? (20pts)
3. In **Emerging Technologies**, the authors refer to a mature emerging technology called “rapid prototyping”. What is this technology? What can it be used for? Give two specific methods commonly employed in producing rapid prototypes. A good place to start is with a small company Dependable Pattern Works, that is a rapid prototype service bureau. http://dpworks.qwestoffice.net/ (20pts)
4. On P 130 of **Emerging Technologies**, the authors point to 4 characteristics of emerging products that control the rate of diffusion (or adoption). Consider these factors in the various segments of the graph on P 135 (Fig 6.2), which actually comes from Moore’s **Crossing the Chasm**. Explain how each of the characteristics’ influence grows and ebbs at each phase of the maturity cycle and what causes them to grow or ebb. (20 pts)
5. Introducing traditional “non-disruptive products to market is facilitated with market studies and focus groups and market simulations.” Explain why these often fail miserably with disruptive never-been-seen-before technology, and what you might do to better hit the market with these types of products. (20 pts)
## Unit 5 – July 21, 2011 — Liquid Battery

### Learning Objectives:
After completing this unit, you will be able to:
- Be familiar with liquid batteries.
- Understand how emerging technologies impact incumbent businesses in a given technology market.
- Realize that incumbent businesses can effect which elements in a business's competitive array can enable them to continue in the face of emerging technologies.

### Assignments to be completed before July 21, 2011

### Assigned Reading:
1. **Managing Emerging Technologies**, Chapter 8
2. Carry out some library or Internet research and investigate “Liquid Batteries.” A good place to start is *Liquid Battery*, Kevin Bullis, MIT Technology Rev, Mar/Apr 2009

### Answer the following questions based on the reading assignments:
1. In *Emerging Technologies*, the authors indicate that when technology-induced changes effect a market, the incumbents will survive and even do well when the change has relatively minor effects on “complementary assets.” What are complementary assets, and why is the above statement true? (20pts)
2. How can businesses influence (often through a kind of “game theory”) which complementary assets will be important? Give some examples (You can use some from the text, or feel free to use similar ones in your own experience). (10pts)
3. Customers are a key element in the success or failure of any product or service. Explain how customers can either inhibit a company's entry into a new emerging technology, or accelerate it. (20pts)
4. Explain how changes in an industry brought about by an emerging technology, can rapidly overwhelm incumbents who are used to dealing with an existing set of known competitors. (20 pts)
5. Describe the “Liquid Battery”. What are they? What are their benefits? Give some potential applications and indicate who are the major players at present. (10 pts)
6. Considering the field of generating electricity by sunlight, explain why these active devices may play an important role. (20pts)
# Learning Objectives:

After completing this unit, you will be able to:

- Be familiar with the roles of strategy, strategic planning, and strategic analysis in fast changing environments
- Understand the roles of imagination and discipline in Strategic planning—their advantages and their limitations
- Understand why the traditional yearly “strategic planning” orgy is no longer effective

# Assignments to be completed before July 28, 2011

## Assigned Reading:

1. **Managing Emerging Technologies**: Chapter 9

## Answer the following questions based on the reading assignments:

1. In *Emerging Technologies*, the authors portray a case study of General Instruments—a company that manufactures boxes for cable TV. Describe what their attitudes towards planning and the future were, and what happened to them. (20pts)
2. The authors also make reference to teachings by Brown & Eisenhardt, which refers to a “relentless flow of competitive advantages.” What can you guess this refers to in terms of strategic planning (versus the more traditional approach referred to in Quest. 1)? (20 pts.)
3. On P. 192, the authors cite Prahalad and Hamel’s statement that “there is a limit to the extent that improvements in operations can sustain growth.” What do you think this means, and do you agree with it? (20 pts)
4. Having a “knowable” future in which one can plan with absolute certainty would guarantee success in strategic planning. Explain how modern fast changing environments brought about by increasing numbers of fast moving emerging technologies results in the four “limitations” referred to on Pp 196-197. (15 pts)
5. What can happen when you “undervalue your past”, as referred to on P 198? (20 pts)
### Unit 7 — Aug 4, 2011 — Manage Short Term—but Commit to the Future

**Learning Objectives:**
- After completing this unit, you will be able to:
  - Explore the role of “Scenario planning” to examine potentials for the future
  - Understand the limit between too little and too much in exploring the future

**Assignments to be completed before Aug 4, 2011**

**Assigned Reading:**
1. *Managing Emerging Technologies*: Chapter 10

**Answer the following questions based on the reading assignments:**
1. In *Emerging Technologies*, the authors sarcastically make the statement: "Figure out where the world is headed, or where you want to take it and then execute." The key elements here are “Figure out.. and then execute.” What is the problem for these elements in today’s fast changing industries? (40 points)
2. Instead of the traditional fixed “linear” strategy planning—the authors refer to “scenario planning.” What is this and why is it a better approach? (Hint: Make sure you read the entire chapter before you answer this question!) (20 points)
3. Explain what the balance is that “must be struck between what the future may really bring, and what the organization is ready to contemplate or must consider for its survival.” What are there dangers in the two extremes that are suggested? (40 points)

### Unit 8 — August 11, 2011 — Wrapping it up

**Learning Objectives:**
After completing this unit, you will be able to:
- Understand the proper roles of the key stakeholders in the IP chain.
- Be familiar with the various approaches to protecting IP—which ones work, which ones don’t and the role of time in the process.

**Assignments to be completed before August 11, 2011—Note: Late assignments will NOT be accepted. You must submit ALL work for the term in hardcopy at the beginning of class. There will be NO exceptions!**

**Assigned Reading:**
1. *Managing Emerging Technologies*: Chapter 11

**Answer the following questions based on the reading assignments:**
1. In *Emerging Technologies*, the authors identify three phases of commercialization for new emerging technologies. Along the way, they point out that “someone” will eventually reap the benefit of the new innovation. Explain why the someone is often not the inventor. If that is the case, what does the inventor get? (50pts)
2. Explain how Starbucks manages to maintain its leadership market position, despite not being able to patent either a particular brand of coffee or clever names such as “café latte.” (40 pts).
3. Summarize what you learned in the course, and what your specific takeaways are. (10)