Prefix, Number and Name of Course: PSM 602 Communication Strategies for Math and Science Professionals

Credit Hours: 3
In Class Instructional Hours: 3   **Labs:** 0   **Field Work:** 0

Catalog Description:
Prerequisites: Graduate-level standing

An examination of communications intended to develop strategic thinking about communication of quantitative information and aid in improving writing, presentation, and interpersonal communication skills for mathematicians and scientists within a variety of settings (i.e. industrial, managerial, academic, research), including a set of "best practices" or guidelines that have been derived from both research and experience. Students will put those guidelines into practice, using a workshop format that will rely heavily on discussion and in-class exercises.

Reasons for Addition:
This course is one of the three foundational PLUS classes required by our new MS (Professional Applied and Computational Mathematics MS), which is a "Professional Science Masters" or PSM, and is also required by many PSM degrees nationwide. Business communications encompasses a set of tools and techniques for planning and executing communications, with an emphasis on communication of data-intensive information to both technical and non-technical parties. While these skills have been taught and used extensively in MBA programs, there has been little work done to incorporate these same practices into the math and science fields of study. In fact, the creation of the Professional Science Master degree has provided a place for the systematic development of management techniques (including business communication) specialized for science and mathematics.

Student Learning Outcomes Students will:	Course Content References	Assessment
1. Assess and apply effective communication techniques in business related activities, including what is unique to the math and science disciplines, and apply the techniques in real-world math and science problems.	I, II, III, IV, V, VI	1. Class/group discussion and participation, individual case assignments, team project, examinations, presentations
2. Communicate quantitative information, both verbally and nonverbally, with clarity, precision, and efficiency, while maintaining statistical integrity, to professionals that may or may not have a technical/mathematical background.	I, II, III, IV, V, VI	2. Class/group discussion and participation, individual assignments (cases, business reports, letters, memos), team project, examinations, presentations
3. Recognize and evaluate cultural intercultural, cross-cultural, and organizational culture) differences that impact members of an organization and formulate appropriate	V	4. Class/group discussion and participation, individual case assignments

communication strategies.		
4. Plan and conduct an interview in both the interviewee and interviewer roles for representative math and science positions in industry.	VI	5. Class/group discussion and participation, individual case assignments, presentations
5. Demonstrate ability to manage and communicate with team members when solving problems, within and outside of the math and science disciplines.	II	7. Class/group discussion and participation, individual case assignments, team project, peer reviews

I. Introduction/Overview of communication
   A. Planning communication between math/science professionals and professionals who may or may not have a technical background
      1. Determine the objective and style (tell, sell, consult, join)
      2. Assessing the audience's technical background
      3. Determine level of technical and quantitative (math, science, computational) expertise of the audience and plan message accordingly – translation of scientific communication units (i.e. theorems, limits, principles, laws) into non-technical professional language
      4. Determine questions and objections
      5. Plan message strategy
      6. Plan visual aids
      7. Plan to make a personal connection
   B. Nonverbal communication between math/science professionals and professionals who may or may not have a technical background
      Integration of the math and science communication units (i.e. theorems, limits, principles, laws) with nonverbal cues
      Movements (emblems, illustrators, affect displays, regulators, adaptors), eye contact and facial behavior, space and territoriality
   C. Active listening and reflective responses between math/science professionals and professionals who may or may not have a technical background
      1. Understanding non-scientific information that may be incomplete, inaccurate
      2. Active listening techniques, reflective response techniques, reflective versus directive responses
   D. Persuasion (The purpose of most business writing is to recommend some course of action.)
      1. Logical arguments (the power of evidence/data)
         a. Testing the evidence (ensuring data and data analysis is reliable, accurate, relevant, representative, and sufficient)
         b. Testing the reasoning: Inductive reasoning, Deductive reasoning, Common reasoning fallacies
         c. Building technical and quantitative evidence into arguments
         d. Presenting the data – one-sided versus two-sided (opposition)
         e. Emotional appeals (especially in environmental   factors)
      2. Direct versus indirect structure
         a. Cognitive factors
         b. Rhetorical factors (direct proof, proof by contradiction, constructive versus non-constructive proofs) and how to translation to professional language
      3. Cialdini's principles (persuasion techniques)
      4. Dialectics

Course Content:

E. Communication styles between math/science professionals and professionals who may or may not have a technical background
1. Determining style of presenter (math/science professional) and audience (professionals who may or may not have a technical background)
   a. Analyst – quantitative and data focus (math and scientists)
   b. Innovator – creative focus (hardest to learn)
   c. Producer – results focus (management)
   d. Diplomat – people focus (human relations)
2. Planning interaction to and between different styles
3. Self-assessment

II.

III. Teams

A. Effective team management – how to lead and participate in a team as a quantitativ member

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1. Characteristics of effective multi-disciplinary teams
2. Stages of team development
3. Participation versus influence
   a. Assessing influence
   b. Increasing participation
4. Conflicts
   a. Constructive conflict
   b. Assessing conflict and intervention measures
5. Team development
   a. Best practices
   b. Guidelines for managing difficult conversations

B. Effective meeting management
1. Planning a meeting for multi-disciplinary teams
2. Roles and responsibilities (i.e. facilitator, time-keeper, scribe)
3. Agenda setting
4. Active and non-verbal listening skills
5. Decision-making methods
6. Ending the meeting (ensuring follow-up and actions)

C. Group problem-solving and decision making

IV. Written communication

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A. Professional writing styles
B. The Pyramid Principle (the logic of writing)
C. Graphical competence (display of statistical information using judgment without distortion)
D. Communication mediums and when to use/not to use
E. Request for proposals (RFPs) (Commonly used in science arena)
1. Writing proposals
2. Responding to proposals
F. Basic business reports (exposure to basic reports common to industries)
G. Social media (i.e Linked In)

Course Content:

V. Oral/verbal communication
 A. Persuasion version informative – picking a technique (see Section I)
 B. Presentations
  1. Visual aids
   a. Choosing a medium and strategy (PPT is not always the best option for quantitative information)
   b. 10/20/30 rule (guidelines for good visuals)
   c. Visual displays of statistical and quantitative information
  2. Questions and answers
   a. What to do before, during, and after the presentation – comparison between different disciplines in professional environments
   b. Giving and receiving feedback and supporting with quantitative information
  3. Hostile audiences
   a. Reasons for hostility (i.e. lack of translation between scientific and non-scientific language)
   b. Using effective listening skills: Attending, encouraging, following, dealing with difficult questions/questioners, delivering effective responses to non-scientific professionals
 C. Public relations
  1. Communication with media
  2. Congressional communication
  3. Public outreach
VI. Intercultural and cross-cultural communication
 A. General guidelines for legal, ethical, cultural, and global issues
 B. Cross cultural variables
  1. In the culture at large
  2. In business and industry
  3. In research and education
 C. Perceptions/values that differentiate cultures
 D. Communication practices that differentiate different cultures
 E. Qualities required for successful cross-cultural communication
VII. Communications in the job search (will work with college-level career support services to target technical job searches – only differences in technical fields to be covered by instructor)
 A. Custom workshop (targeted to technical students) – Mock Interviews with actual employer in related field (already discussed and cleared with college-level career support director)
 B. Differences between:
  1. Traditional job searching techniques and those for Professional Science Master's (PSM)
  2. Education versus industry
  3. Related industries and search tools for PSM jobs

Scholarships:

Ancona, Deborah, et al. "Team Decision Making." In *Managing for the Future: Organizational Behavior and Processes*. 3rd ed. Cincinnati, OH: South-Western College Pub, 2004, pp. 16-24.

Andrews, Deborah, and William Andrews. *Management Communication: A Guide*. Cincinnati, OH: South Western College Pub, 2003.

Arredondo, Lani. *Communicating Effectively*. New York: McGraw-Hill, 2000.

Hacker, Diana. <u>A Writer's Reference</u>, 6th ed. Boston: Bedford/St. Martin's, 2006.

Harvey, Gordon. *Writing with Sources: A Guide for Students*. Indianapolis, IN: Hackett Publishing, 1998.

Hamlin, Sonya B. "The Art of Q & A." In *How to Talk So People Listen: The Real Key to Job Success*. New York, NY: Harper Paperbacks, 1989.

Hattersley, Michael, and Linda J. McJannet. "Giving and Receiving Feedback." In *Management Communication: Principles and Practice*. New York, NY: McGraw-Hill, 1996, pp. 143-148.

Kawasaki, Guy. *Reality Check*. New York: Penguin Publishing, 2008.

Kessler, Lauren, and Duncan McDonald. *When Words Collide: A Media Writer's Guide to Grammar and Style*. Belmont, CA: Wadsworth Publishing, 1999.

Markel, M. *Technical Communication.* Boston, MA: Bedford/St. Martin's, 2010.

Munger, R. *Document-Based Cases for Technical Communication.* Boston, MA: Bedford/St. Martin's, 2005.

Munter, Mary. *Guide to Managerial Communication*. 7th ed. Upper Saddle River, NJ: Prentice Hall, 2005.

Schein, Edgar. "The Process of Building and Maintaining a Group." Chapter 4 in *Process Consultation*. Upper Saddle River, NJ: Prentice Hall, 1988.

Tufte, Edward. <u>The Visual Display of Quantitative Information</u>. Cheshire, CT: Graphics Press, 2001.

Williams, Joseph. *Style: Toward Clarity and Grace*. Chicago, IL: University of Chicago Press, 1995.

<u>Writing Scientific Research Articles: Strategy and Steps</u>. John Wiley and Sons Ltd, March 2009.

Zelazny, Gene. *Say It with Charts: The Executives Guide to Visual Communication*. New York, NY: McGraw-Hill, 2001.

Zelazny, Gene. *Say It With Presentations*. New York, NY: McGraw-Hill, 2006.

Periodicals:

Ballaro, Beverly. " Six Ways to Grab Your Audience Right from the Start." Harvard Management Communication Letter, June 2003.

Barnes, Louis. "Managing Interpersonal Feedback." *Harvard Business School Case*. Cambridge, MA. 1989. Case No. 9-483-027.

Billington, Jim. "The Three Essentials of an Effective Team." Harvard Management Update, January 1997.

Brent, Douglas. "Indirect Structure and Reader Response." *The Journal of Business Communication* 22, no. 2 (Spring 1985): 5-8.

Breslow, Lori, and Neal Hartman. "Intercultural Communication." Cambridge, MA: MIT Sloan School, November 14, 2007.

Cialdini, Robert. "Harnessing the Science of Persuasion." *Harvard Business Review*, October 1, 2001. No. R0109D.

Crawley, Charles R. "Technical Communication: A Reader-Centered Approach." *Technical Communication*, 58, No. 1, (2011): p. 86-87.

Daly, John, and Isa Engleberg. "Coping with Stagefright." *Harvard Management Communication Letter* 2, no. 6 (June 1999): 1-4.

de Jong, Menno D. T. "Exploring the Borders of Technical Communication: Corporate and Organizational Communication." *Technical Communication*, 58, No. 1, (2011): p. 1-3.

Dombrowski, Paul M. "Practicing "Safe" Technical Communication." *International Journal of Technical Writing & Communication (IJTW)*, Volume 41; Issue 3, July 2011

Farkas, Maria T., and Linda Hill. "Note on Team Process." Boston, MA: Harvard Business School Publishing, October 4, 2001. No. 402-032.

Govindarajan, Vijay, and Anil K. Gupta. "Building and Effective Global Business Team." *MIT Sloan Management Review* 42, no. 4 (2001): 63-71.

"Handling Q&A: The Five Kinds of Listening." *Harvard Communications Update* (February 1999): 6-7.

Jarvis Kwadzo Bokor, Michael. "Connecting with the 'Other' in Technical Communication: World Englishes and Ethos Transformation of U.S. Native English-

Speaking Students." *Technical Communication Quarterly*, Apr-Jun2011, Vol. 20 Issue 2, p208-237.

Katzenbach, Jon R., and Douglas K. Smith. "The Discipline of Teams." *Harvard Business Review*, July 1, 2005.

Lev-Ram, Michal. "Data scientist: the hot new gig in tech." *Fortune*, September 6, 2011.

Matsuda, Aya and P.K. Matsuda. "Globalizing Writing Studies: The Case of US Technical Communication Textbooks." *Written Communication*, 28, no. 1 (2011): p. 172-192.

Obuchowski, Janice. "Your Metting: Who's in Charge?" *Harvard Management Communication Letter*, April 1, 2005.

Paine, Lynn Sharp, and Harold F. Hogan, Jr. "Shanghai Real Estate." HBS Case: 9-398-088, December 17, 1997.

Rhoads, Bruce, *et. al.* "Interaction between Scientists and nonscientists in community-based watershed management: emergence of the concept of neutralization." *Environmental Management*, 24, no. 3 (1999): 297-308.

Riccomini, Donald R. "The Essentials of Technical Communication." *Technical Communication*, 58, No. 1, (2011): p. 91-92.

Swift, Marvin H. "Clear Writing Means Clear Thinking Means." *Harvard Business Review* (January-February, 1973). Cambridge, MA. (Now also a Harvard Business School Case, No. 73111.)

Van Broeck, Sigurd, Zhe Lou, and Marc Van den Broeck. "Real-time 3D video communication in 3D virtual worlds: Technical realization of a new communication concept." *Bell Labs Technical Journal*, Jun2011, Vol. 16 Issue 1, p. 63-76.

Vanhonacker, Wilfried R. "When Good Turns Bad." *Harvard Business Review*, April 1, 2004.

Von Hoffman, Constantine. "Getting the Most from Presentation Software." *Harvard Management Communication Letter* 2, no. 6 (June 1999): 7-8.

Yu, Han. "Integrating Technical Communication Into China's English Major Curriculum." *Journal of Business and Technical Communication*, 25, no. 1 (2011): p. 68-94.

Electronic and/or Audiovisual Resources:

http://www.pmi.org The Project Management Institute

http://www.stc.org/ The Society for Technical Connunication

http://www.researchandmarkets.com/research/499a5c/journal_of_technical_writing_and_ communication Journal of Technical Writing and Communication

http://www.marketresearch.com/ Basic Communication Skills for Technical Managers, June 2011