

**Executive Masters in Crisis and Emergency Management
The Science of Catastrophes
ECEM 712 Summer-Fall 2007**

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Disability Resource Center (DRC) is the official office to provide Disability Services. If you have a documented disability that may require assistance, you will need to contact DRC for coordination in your academic accommodations. DRC is located in the Reynolds Student Services Complex, suite 137. The phone number is 702-895-0866, or TTD 702-895-0652. You may also visit the website at www.unlv.edu/studentinf/les

Course Description:

This course provides the scientific basis for evaluating and interpreting risks, hazards, and catastrophes. This course provides an understanding of the underlying scientific issues that arise from natural, intentional, and technical events. This course will cover the necessary principles of traditional sciences and engineering as they pertain to emergency management. Key components of the course will cover aspects of biology, geology, meteorology, civil and structural engineering, statistics and dynamics as they pertain to non-structural hazard mitigation, and the basics of chemistry as they pertain to fires, explosives and hazardous materials issues. It presents information at a managerial level, providing students with a sufficient overview to recognize and understand the complexity of potential catastrophic events that they must plan for and manage. The workings of the natural and constructed worlds have interdependencies and consequences. The most important aspect of this course is that interdependent systems and their dynamics are the catalysts for catastrophes. Science attempts to explain and provide understanding about how and why things happen. This course assumes that students possess little or no scientific backgrounds. It is a non-technical treatment of science, scientific methods, and some ways that science can be applied to understand risks, hazards, and catastrophes. Students will only perform basic arithmetic functions: addition, subtraction, multiplication, and division. Students will benefit professionally from the application of scientific methods and general systems theory to work-related and real-world problems.

Course Objectives:

- Define the major components of science and reasons why we use it to study catastrophes
- Describe how scientific method and general systems theory can be used to model catastrophes
- Compare and contrast case studies of catastrophes

- Apply system dynamics tools to selected work problems and catastrophes
- Examine dynamic problems associated with catastrophes
- Classify the dynamic behavior of selected catastrophes
- Explain the causal links that triggered selected catastrophes
- Distinguish science from pseudoscience in selected written accounts of catastrophes
- Design a study that conforms to scientific method to examine a local catastrophe
- Hypothesize about the causes leading to a local catastrophe
- Evaluate how scientific method supports the understanding of catastrophes
- Assess the value of applying the principles of system dynamics to understand risks, hazards, and catastrophes
- Recognize the major elements of natural, intentional, and technical disasters
- Educate emergency managers and other safety professionals on the role physical, biological, and chemical sciences and engineering play in improving public safety
- Analyze natural events, such as floods, fires, hurricanes, tsunamis, earthquakes, tornadoes, epidemics, etc. and determine the scientific and engineering issues which arise from such events
- Analyze intentional events, such as acts using chemical, biological, radiological, nuclear, and high-yield explosives and determine the scientific and engineering issues which arise from such events
- Analyze technical events, such as hazardous materials releases; power, gas, and water disruptions; transportation accidents, etc. and determine the scientific and engineering issues which arise from such events
- Illustrate how knowledge can be utilized in hazard mitigation implementation and emergency response planning
- Prepare students in this course to engage in the exercise design and plan evaluation course in Module 2 and the capstone course in Module 3

Books:

- *A Beginner's Guide to Scientific Method* by Stephen S. Carey. Third Edition. Wadsworth. 2004.
- *Systems Thinking Basics: From Concepts to Causal Loops* by Virginia Anderson and Lauren Johnson. Pegasus. 1997.
- *The Structure of Scientific Revolutions* by Thomas Kuhn. University of Chicago. 1996.
- *The Mathematics of Natural Catastrophes* by Gordon Woo. Imperial College Press. 1999.

Suggested Websites:

- A specific list of disaster websites will be provided and more websites will be suggested in the class discussions and readings
- Students may subscribe to discussion lists for a variety of disaster organizations and related professions and receive email notification of major earthquakes and other disasters, federal disaster relief announcements, job announcements, research opportunities, and other relevant professional news from the field.
- www.fema.gov - for basic information on the federal emergency management system, reports, legal documents, training and planning documents, and status reports on disasters, as well as links to state and local emergency management agencies www.dhs.gov - for basic

information on the Department of Homeland Security, including FEMA, and its constituent agencies and directorates

- www.iaem.com - for information on the International Association of Emergency Managers, job listings, commentary on current policy issues
- www.colorado.edu/hazards - for information regarding specific hazards, full texts of some of the Natural Hazards Center's series of working papers and quick response reports for recent disasters, and other information resources
- www.drc.udel.edu - for applied social science research related to disasters, full texts of some of the Disaster Research Center's publications, including reports to FEMA and other government agencies
- www.emforum.org - Emergency Information Infrastructure Partnership (EIIP) forum. Holds Internet workshops on a broad range of emergency management issues and maintains an archive of transcripts. Tune in online for Wednesday noon programs

Suggested Journals:

- *The ASPEP Journal* (American Society of Professional Emergency Planners)
- *The Australian Journal of Emergency Management*
- *Disaster Prevention and Management: An International Journal* (UK)
- *Disaster Recovery Journal* (for Business Continuity Planners)
- *Disasters: The Journal of Disaster Studies, Policy and Management*
- *Environmental Hazards: Human and Policy Dimensions*
- *Homeland Protection Professional*
- *International Journal of Mass Emergencies and Disasters* (International Research Committee on Disasters, American Sociological Association)
- *Journal of Contingencies and Crisis Management* (The Netherlands)
- *Journal of Emergency Management*
- *Journal of Homeland Security and Emergency Management* (electronic)
- *The Liaison (for Civil-Military Humanitarian Relief Collaboration)* (Center of Excellence in Disaster Management and Humanitarian Assistance, Hawaii)
- *Natural Hazards: An International Journal of Hazards Research & Prevention*
- *Natural Hazards Review* (Natural Hazards Center, University of Colorado)

COURSE POLICIES

Make-ups for the mid-term and final exams will be limited to very special circumstances only and will require prior notification and approval.

Completion of assigned reading is expected.

Students can turn in assignments early. None will be accepted after their due dates' and times' expiration.

The American Psychological Association (APA) style manual is the only writing style manual permitted. All written assignments must conform to the APA standards.

Handwritten assignment submissions are not acceptable.

There will be no extra credit or make up work.

UNLV policy governs Incompletes.

Plagiarism and other forms of cheating will automatically result in a failing grade.

Objectives Measurement:

All assignments must be submitted through WebCampus by the due date and time. You may submit them earlier if you desire, but no assignments will be accepted after the due date and time expires. Bear in mind that your PC clock and the WebCampus server clock might differ, so don't cut it close. The WebCampus server clock will determine timely submission. Students must submit assignments through the Webcampus Assignment Submission tool as attachments; no copy/paste into comment boxes; email submissions will not be accepted.

Total Points: 700 points possible

630-700: A

560-629: B

490-559: C

489-Below: Not Passing

Mid-term exam = 50 points

Final exam (cumulative) = 50 points

Reading and Writing Assignments:

- Weekly or bi-weekly reading and written assignments worth 190 points.
- Reading and critical analyses of Woo chapters worth 95 points.
- Group projects and threaded discussions worth 95 points
- Submit the following written assignment **not later than 1800 hours Sunday, November 25, 2007** for discussion at the 2nd on-campus session: Evaluate at least three assertions made by Kuhn in *The Structure of Scientific Revolutions*. Worth 100 points total--75 points for written; 25 points for in-class discussion.
 - What does Kuhn assert?
 - What evidence does he offer for his assertions?
 - Does the evidence support the assertions? Why or why not?
 - Are you a proponent or opponent of Kuhn's assertions? Why?
 - Explain how Kuhn has affected the way you conceive of science compared with what conceptions you held prior to this course.

Research Paper Assignment:

*3 part research paper worth 40 points for each part. The purpose for 3 parts is to allow for gradual enhancement of writing skills. Non-traditional students who have been away from scholarly writing for 10, 20, 30 or more years have benefited from this approach, rather than receiving a low score on a single end-of-term paper due to writing challenges. For this research paper, the student will address a single focus area drawn from the Quick Response Reports found at: <http://www.colorado.edu/hazards/>. Several suggested topics to explore are in the WebCampus Week 1 folder for this course.

Part 1: Lay the foundation, cite the supporting academic literature, and then hypothesize about the causes leading to a catastrophe occurring in the Focus Area chosen.

Part 2: Assess the value of applying the principles of system dynamics to understand the risks, hazards, and consequences of a catastrophe in the chosen Focus Area.

Part 3: Evaluate how scientific method could support problem definition, system dynamics, and the understanding of a catastrophe in the chosen Focus Area.

Factors to remember in writing this research paper:

- 1) Each part must be 3-5 typed, double-spaced pages with 1-inch margins & 12 pt font
- 2) Papers must conform to the APA style manual.
- 3) Read and understand the assignment for each part. Ask questions if you are not sure.
- 4) The use of the Internet is acceptable to survey topics for ideas, but all information supporting this paper must have sound academic journal sources. Wikipedia is not an academic source. Personal opinions are not facts.

NOTE: Either use MS Word to save and submit assignments, or save your files as .rtf format. PDF files are also acceptable, so long as they are not scans of handwritten documents. Do not send WordPerfect documents.

ECEM 712 Assignment Schedule

Week 1 (Jul 2-8): Orientation Week

- Login to the course. NOTE: All time notations refer to the U.S. Pacific Time Zone. This course uses military time. Military time provides clear deadlines. 0800 hours is 8:00 a.m. 2000 hours is 8:00 p.m.
- Review the syllabus and use the assignment submission tool in WebCampus to inform me that you did this. **Due not later than 1800 hours on Sunday, July 8, 2007.**
- Read these three articles located at:
<http://sysdyn.clexchange.org/sd-intro/home.html>
The Beginning of System Dynamics D-4165-1
Learning through System Dynamics as Preparation for the 21st Century D-4434-1
System Dynamics Meets the Press D-4143
 - Submit a written assessment for one of the three articles and discuss its pertinence to examining the science of catastrophes. Support your arguments with academic sources. **Due not later than 1800 hours on Sunday, July 27, 2007.**
- Read Woo, Chapter 1. **Due not later than Sunday, July 8, 2007.**
- Participate in an asynchronous blog. Introduce Blog access will be open only from **0800 hours July 2 through 1800 hours July 8.** Topic: Introduce Yourself.
 - Tell us who you are; where you are; your parent organization; what your day job is; your background in science; your experience with emergency management; how YOU define science (no looking it up); and what YOU would consider a catastrophe to be (not a dictionary definition).

Week 2 (Jul 9-15): Introduction to Systems Thinking

- Read Systems Thinking Basics Section 1. Complete activities 1-3. Submit all activities as WebCampus email attachments. **Due not later than 1800 hours**

- Sunday, July 15, 2007.** Credit will only be given for responses that are independent student thought, not for responses copied from the appendix.
- Read Systems Thinking Basics Section 2. Complete activities 1-5. Submit all activities as WebCampus email attachments. **Due not later than 1800 hours Sunday, July 15, 2007.** Credit will only be given for responses that are independent student thought, not for responses copied from the appendix.
 - Submit critical analysis of Woo Ch. 1. **Due not later than 1800 hours Sunday, July 15, 2007.**
 - Participate in an asynchronous threaded discussion that will be available beginning at **0800 hours Monday, July 9, 2007 through 1800 hours Sunday, July 15, 2007.**
Topic: Systems thinking for emergency management.

Weeks 3 & 4 (Jul 16-27): System Dynamics and Dynamic Problems

- Read Woo, Ch. 2. **Due not later than Sunday, July 22, 2007.**
- Submit critical analysis of Woo Ch.2. **Due not later than Friday, July 27, 2007.**
- Read Gillespie, Robards, and Cho. **Due not later than Sunday, July 22, 2007.**
- Read Section 3 Systems Thinking Basics. Complete Activities 1-3. Submit all activities through WebCampus Assignment tool as attachments. **Due not later than 1800 hours Friday, July 27, 2007.** Credit will only be given for responses that are independent student thought, not for responses copied from the appendix.
- Participate in an asynchronous threaded discussion that will be available beginning at **0800 hours Monday, July 23, 2007 through 1800 hours Friday, July 27, 2007.**
Topic: How can System Dynamics be used to model catastrophes?

Please Note: Week 5 is the first on-campus session

- Review previous readings for class discussion.
- Overview of conventional sciences and engineering as they pertain to emergency management

Weeks 6 & 7 (August 6-19): Depicting System Structures

- Read Woo, Ch. 3. **Due not later than 1800 hours Sunday, August 12, 2007.**
- Submit critical analysis of Woo, Ch. 3. **Due not later than 1800 hours Sunday, August 19, 2007.**
- Submit Behavior-Over-Time graph (BOT graph) for selected risk, hazard, or catastrophe **not later than 1800 hours Sunday, August 19, 2007.**
- Read Systems Thinking Basics Section 4. **Due not later than 1800 hours Sunday, August 12, 2007.**
- Activities for section 4 are due **not later than 1800 hours, Sunday, August 19, 2007.** Section 4 activity #6 must be submitted as CLD in a MS Word document.
- Participate in asynchronous threaded discussion open from **0800 hours Monday, August 13 through 1800 hours Sunday, August 19, 2007.** Topic: Classify the dynamic behavior associated with selected catastrophes drawn from the Quick

Response Reports archived at the Hazards Research Center. Be specific about the exact incident and the behavior you are discussing within the incident.

Weeks 8 & 9 (Aug 20-Sep 2): Depicting System Structures

- Read Systems Thinking Basics Section 5, pp. 77-86. **Due not later than 1800 hours Sunday, August 26, 2007.**
- Read Woo, Ch. 4. **Due not later than 1800 hours Sunday, August 26, 2007.**
- Submit critical analysis of Woo, Ch. 4. **Due not later than 1800 hours Sunday, September 2, 2007.**
- Participate in asynchronous threaded discussion **open from 0800 hours Monday, August 27, 2007 through 1800 hours Sunday, September 2, 2007.** Topic: Creating causal loop diagrams for risks, hazards, and catastrophes. Within your groups, select a QRR disaster case study. Work through the CLD development cycle. **The end deliverable due at 1800 hours on Sunday, September 2, 2007,** is a complete group-developed, CLD that describes completely the system behavior and structures within the selected QRR case. Indicate the relative percentage of effort contributed by each group member to publish the final product.
- **Due not later than 1800 hours Sunday, September 2, 2007: Part 1 research paper.**

Weeks 10 & 11 (Sep 3-16): Refining CLDs: Stock and Flow Diagrams

- Read Systems Thinking Basics Section 6. **Due not later than 1800 hours Sunday, September 9, 2007.**
- Read Roberts: From Causal Loops to Stock and Flow; 3312-The Problems with Causal Loops; and 4691-Introduction to Feedback Exercises. **Due not later than 1800 hours Sunday, September 9, 2007.**
- Read Woo, Ch. 5. **Due not later than 1800 hours Sunday, September 9, 2007.**
- Submit critical analysis of Woo, Ch. 5. **Due not later than 1800 hours Sunday, September 16, 2007.**
- Complete the online **mid-term exam open from 0800 hours Thursday, September 13 through 1800 hours Sunday, September 16, 2007.**

Weeks 12 & 13 (Sep 17-30): Beginner's Models; The Tragedy of the Commons

- Read Roberts: Simulations for Positive and Negative Loops; 4347-Beginner Modeling Exercises. **Due not later than 1800 hours Sunday, September 23, 2007.**
- Read Woo, Ch. 6. **Due not later than 1800 hours Sunday, September 23, 2007.**
- Participate in asynchronous threaded discussion **open from 0800 hours Monday, September 24 through 1800 hours Sunday, September 30, 2007.** Topic: The Tragedy of the Commons (p. 125 in STB).
- Each group must submit an analysis about how Garrett Hardin's Tragedy of the Commons relates to the study of the science of catastrophes. Submit the group's analysis **due not later than 1800 hours Sunday, September 30, 2007.**

- BOT graphs, CLDs, will form the basis of the group's grade. Review the criteria for each.

Weeks 14 & 15 (Oct 1-14): Hazardous Weather; Scientific Method Introduction

- Read A Beginner's Guide to the Scientific Method Chapters 1 & 2 (ABG). **Due not later than 1800 hours Sunday, October 7, 2007.**
- Complete all exercises individually for ABG Chapters 1 & 2 and submit through WebCampus **not later than 1800 hours Sunday, October 14, 2007.**
- Read Woo, Ch. 7. **Due not later than 1800 hours Sunday, October 7, 2007.**
- Submit critical analysis of Woo, Ch. 7. **Due not later than 1800 hours Sunday, October 14, 2007.**
- Complete the Hazardous Weather online course and forward the email confirmation from the Emergency Management Institute that you successfully completed the course **not later than 1800 hours Sunday, October 14, 2007.**
- **Due not later than 1800 hours Sunday, October 14, 2007: Research paper Part 2.**

Weeks 16 & 17 (October 15-28): Proposing and Testing Explanations; Ockham's Razor

- Read ABG Chapter 3 and 4. **Due not later than Sunday, October 21, 2007.**
- Read Woo, Ch. 8. **Due not later than Sunday, October 21, 2007.**
- Submit critical analysis of Woo, Ch. 8. **Due not later than Sunday, October 28, 2007.**
- Participate in asynchronous threaded discussion **open 0800 Monday, October 22 through 1800 Sunday, October 28, 2007, 2007.** Topic: Exercise # 18, Chapter 3 ABG.
- Group 1 complete and submit solutions to Exercises #4-8, Chapter 3 ABG; Group 2 complete and submit solutions to Exercises #9-13, Chapter 3 ABG; Group 3 complete and submit solutions to Exercises #14-19 (skip 18); and Group 4 complete and submit solutions to Exercises #20-24, Chapter 3 ABG **due not later than 1800 hours Sunday, October 28, 2007.** Indicate the relative amount of contribution provided by each group member on the group submission.

Weeks 18 & 19 (Oct 29-Nov 11): Causal Links; Fallacies in the Name of Science

- Reach ABG Chapters 5 and 6. **Due not later than 1800 hours Sunday, November 4, 2007.**
- Read Woo, Ch. 9. **Due not later than 1800 hours Sunday, November 4, 2007.**
- Submit critical analysis of Woo, Ch. 9. **Due not later than 1800 hours Sunday, November 11, 2007.**
- Participate in asynchronous threaded discussion **open from 0800 Monday, November 5 through 1800 hours Sunday, November 11, 2007.** Topic: Exercise #12, p. 93 ABG.
- Working with each other through the discussion tool, complete the design of the three types of studies for a selected catastrophe in the QRR archives. Division of labor

might be a good thing. Copy me on any interactions off-discussion that you have. The final report should be completed and submitted through WebCampus **not later than 1800 hours Sunday, November 11, 2007 as a class project**. Indicate the relative contribution by each student in the final submission.

- Each group must complete and submit a solution to a media report about a catastrophe that involves one or more of the fallacies contained in ABG Chapter 6, by applying some of the ideas contained in Chapters 2-5. **Due not later than 1800 hours Sunday, November 11, 2007 submitted through WebCampus**. Indicate the relative contribution by each group member in the submission.

Weeks 20 & 21 (Nov 12-25): Final Exam and Written Assignments

- Read Woo, Chs. 10 & 11. **Due not later than 1800 hours Sunday, November 25, 2007.**
- Complete the online **final exam open from 0800 hours Monday, November 19 through 1800 hours Sunday, November 25, 2007.**
- **Due not later than 1800 hours Sunday, November 25, 2007:** Written assignment covering the evaluation of *The Structure of Scientific Revolutions*. Must be submitted through WebCampus by this date and time or it will be considered “Missed” and not accepted if hand carried to the 2nd on-campus meeting. We will discuss this assignment at the 2nd on-campus meeting.
- **Due by 1800 hours Sunday, November 25, 2007 submitted through WebCampus: Research paper Part 3.** If not submitted through WebCampus by this date and time it will be considered “Missed” and not accepted if hand carried to the 2nd on-campus meeting.

Week 22 (Nov 26-29):

Students use this week as preparation time for the second on-campus session.

Week 23 (Dec 2-7): Second On-Campus Session

- Class discussion of Kuhn’s *The Structure of Scientific Revolutions*
- Class discussion of Woo **Chapters 10 & 11.**
- **On-campus individual student presentations of their research papers Part 3.** Posters, PowerPoint presentations, and handouts are required to brief the class and guests adequately. Students must structure their presentation so that it covers 30 minutes for delivery, with an additional 15 minutes allotted for a question and answer period. Questions must be prepared in advance that the presenter will ask the class.

WRITING CENTER

One-on-one or small group assistance with writing is available free of charge to students at the Writing Center, located in CDC-301. Although some walk-in appointments are sometimes available, students with appointments will receive priority assistance. Appointments may be

made in person or by calling 895-3908. When you go to your appointment, please take a copy of your assignment and any writing that you may have completed on the assignment.

This syllabus is a guide, not a contract. It may be revised if it seems in the best interest of the class to do so. Students will be notified promptly of any revisions.