

SEMESTER AT SEA COURSE SYLLABUS

Voyage: Spring 2013

Discipline: Engineering, open to non-engineering students

CE 3100: Water for the World

Division: Upper Division

Faculty Name: Gearold Johnson

Pre-requisites: None

COURSE DESCRIPTION

Water is the Earth's most precious resource. This course introduces students interested in sustainable international development and global issues to one of the major challenges we face today: how to provide safe drinking water to 1 billion people and adequate sanitation to 2.6 billion people who currently lack these basic services? Students will learn the fundamentals of water quality, water borne diseases, and the basic principles of water and wastewater treatment. Our focus will be on how to select appropriate and sustainable technologies for water and sanitation in developing countries.

COURSE OBJECTIVES

The goal of this course is to develop students' knowledge and understanding of the highly complex issues surrounding water, its availability and uses on a global basis. This will include its history, current global water issues, water treatment processes for clean drinking water, wastewater treatment and solid waste management, worldwide. Special emphasis will be given to understanding systems in the countries visited on the Spring semester at sea voyage. This goal will be accomplished through five objectives:

1. To understand the global issues surrounding the uses and needs of water.
2. To understand the current issues associated with provision of clean drinking water and improved sanitation to the world's population.
3. To build students' knowledge and comprehension of the history of water and sanitation infrastructure.
4. To develop a global perspective on water supply and waste treatment.
5. To understand the role of physical, chemical and biological principles in potable water and wastewater treatment processes and solid waste management.

REQUIRED TEXTBOOKS

AUTHOR: Maggie Black & Janet King

TITLE: The Atlas of Water: Mapping the World's Most Critical Resource

PUBLISHER: University of California Press

ISBN #: 978-0-520-25934-8

DATE/EDITION: 2009/2nd Edition

COST: \$22.95

AUTHOR: Joanne E. Drinan and Frank R. Spellman

TITLE: Water and Wastewater Treatment: A Guide for the Nonengineering Professional

PUBLISHER: CRC Press

ISBN #: 978-1-4398-5400-6

DATE/EDITION: 2013/2nd Edition

COST: \$99.95

TOPICAL OUTLINE OF COURSE

NOTE: Readings are from Drinan & Spellman (D&S) and Black and King (B&K)

Class 1: INTRODUCTIONS, COURSE OVERVIEW AND REQUIREMENTS, WHAT DO YOU KNOW ABOUT WATER?

Class 2: LET'S ORGANIZE YOUR WATER KNOWLEDGE, EXAMINE THE RESULTING TREE, WHAT DO WE SEE?

Class 3: BRIEF HISTORY OF WATER AND SANITATION, notes from instructor

Class 4: WATER AND SANITATION OVERVIEW IN THE COUNTRIES TO BE VISITED; B&K pp 101-117 and WWDR3 (from instructor)

Class 5: WATER: A FINITE RESOURCE: The Global Water Pot, Water Shortage, Rising Demand, Dwindling Supply and Competition and Conflict; B&K pp 18-29 and D pp 7-17

Class 6: ENVIRONMENTAL PRESSURES: Climate Change, Urbanization, Altered

Flows, Draining Wetlands, Dry Lands, Droughts and Floods; B&K pp 30-43

Class 7: WATER FOR LIVING: Water for Drinking, Water for Sanitation, Water at Home, Water and Disease, Disease Vectors, Water for Food and Dispossession by Water; B&K pp 45-59

Class 8: WATER FOR ECONOMIC PRODUCTION: Irrigation, Water for Industry, Water for Energy, Water for Fisheries, Transport, Leisure and Water for Sale; B&K pp 61-73

Class 9: DAMAGED WATER: Water Pollutants, Water Pollution, Damaged Waterways and Threatened Ecologies; B&K pp 75-84

Class 10: WATER FOR THE FUTURE: Millennium Development Goals, Treaties and Obligations, Deepening Co-operation, Managing Water, Water Footprint, Water at a Price and Technological Fixes; B&K pp 85-99

Class 11: MID-TERM EXAMINATION

Class 12: LEGAL FRAMEWORKS, US CLEAN WATER DRINKING ACT, UN and EU ACTS, WWDR3 (from instructor)

Class 13: UNIT OPERATIONS FOR PRODUCING CLEAN DRINKING WATER: Sources and Filters, Coagulation and Flocculation, D&S pp 3-93

Class 14: CLEAN DRINKING WATER 2: Sedimentation and Filtration, D&S pp 95-104

Class 15: CLEAN DRINKING WATER 3: Disinfection and Distribution, D&S pp 99-125

Class 16: UNIT OPERATIONS FOR WASTEWATER & SEWAGE TREATMENT:

Wastewater Characteristics, Sources, Types and Treatment, D&S pp 129-146

Class 17: WASTEWATER & SEWAGE TREATMENT 2: Collection Systems, Primary Sedimentation and Biological Treatment, D&S pp 149-189

Class 18: WASTEWATER & SEWAGE TREATMENT 3: Secondary Sedimentation, Advanced Treatment, Disinfection and Discharge Effluent, D&S pp 191-216

Class 19: MANAGEMENT OF SOLID WASTE, D&S pp 219-258

Class 20: SUSTAINABLE CLEAN WATER DEVELOPMENT & SANITATION SYSTEMS, notes from instructor

Class 21: RESEARCH PROJECT PRESENTATIONS

Class 22: RESEARCH PROJECT PRESENTATIONS

Class 23: FINAL EXAMINATION

FIELD WORK

Required field lab will include presentations by the operators and tours of municipal water and/or wastewater treatment plants. Students will be expected to prepare written summaries of the field lab.

***FIELD LAB** (At least 20 percent of the contact hours for each course, to be led by the instructor.)*

Arrangements are underway to spend a 6-8-hour day with presentations and tours of the Singapore Municipal NEWater Facilities.

FIELD ASSIGNMENTS

- Students will be required to attend the Field Lab. Absence from the Field Lab will result in a loss of 20% of the course grade.
- Each student will prepare a written document describing the Field Lab experience highlighting what is learned and how it fits within material covered in class.

- For non-required field excursions, students will be expected to observe local water-supply systems and investigate local perspectives on water supply, water quality, and perceptions about water and health. The results of these observations are to be included in the written Team Project Report.
- Students will be expected to take photographs and/or videos of relevant water-related activities.
- Each written document describing the Field Lab experience will be graded and returned to the student for further refinement.

METHODS OF EVALUATION / GRADING RUBRIC

TEAM PROJECT: The instructor will assign each student to a team of 3 or 4 students to work on a term long project. Each team will report on the status of access to water and sanitation services and the implications of this status for public health and sustainable development in one of the countries visited on the voyage as a case study. Students may take and include photographs and videos. All the team projects will be assembled into an electronic portfolio documenting the water issues in the countries visited as a take-away from the course.

INDIVIDUAL RESEARCH PROJECT: Each student will be responsible for selecting a meaningful topic on some water issue and writing a report and preparing an in-class presentation. Topics may be social, political, economic, cultural or technological in scope. For example, researching the political conflict in Malawi over the water in Lake Nyasa that borders three countries: Malawi, Mozambique, and Tanzania. Other topics might include the effects of global climate change on a particular country or region; droughts around the Horn of Africa, flooding in Pakistan or Bangladesh; the future of desalination; or many others to be worked out with the instructor.

- 10% Attendance and Class Participation
- 15% Mid-term Examination
- 10% Team Paper on Water Resources and Uses in a Country Visited or Near By
- 20% Individual Research Project Paper and Presentation
- 20% Field Lab (participation and e-portfolio)
- 25% Final Examination

Total 100%

RESERVE LIBRARY LIST

AUTHOR: Brian Fagan
TITLE: Elixir: A History of Water and Humankind
PUBLISHER: Bloomsbury Press
ISBN #: 978-1608190034
DATE/EDITION: June 2011
COST: \$28.00

AUTHOR: Steven Solomon
TITLE: Water: The Epic Struggle for Wealth, Power and Civilization
PUBLISHER: Harper Perennial
ISBN #: 978-0060548315
DATE/EDITION: January 2011
COST: \$17.99

AUTHOR: Carsten Hollaender Laugesen and Ole Fryd
TITLE: Sustainable Wastewater Management in Developing Countries: New Paradigms and Case Studies from the Field
PUBLISHER: ASCE Press
ISBN #: 978-0784409992
DATE/EDITION: December 2009
COST: \$75.00

DVD

Author: A film by Irena Salina
Title: Flow: How did a handful of corporations steal our water?
Publisher: Oscilloscope Laboratories
Length: 84 minutes
Date: 2008

ELECTRONIC COURSE MATERIALS

UNESCO World Water Assessment Program (WWAP)
The World Water Development Reports, Nos. 1 (2003), 2 (2006), 3 (2009) and 4 (available in 2012)
For example: WWDR3_Water_in_a_Changing_World.pdf
The United Nations Water Development Update Report 3

ADDITIONAL RESOURCES

May be supplied by the instructor through the course folder.

HONOR CODE

Semester at Sea students enroll in an academic program administered by the University of Virginia, and thus bind themselves to the University's honor code. The code prohibits all acts of lying, cheating, and stealing. Please consult the Voyager's Handbook for further explanation of what constitutes an honor offense.

Each written assignment for this course must be pledged by the student as follows: "On my honor as a student, I pledge that I have neither given nor received aid on this assignment." The pledge must be signed, or, in the case of an electronic file, signed "[signed]."

