

APPENDIX TWO

(Sample One page Syllabus for Academic Quality Work)

Tennessee Technological University
Department of Civil & Environmental Engineering
CEE 6440 – Hydrometeorology

2010 Catalog Data: CEE 6440: Hydrometeorology. Credit 3. Theory and observations of hydrological processes in landsurface and atmosphere. Precipitation processes, radiation and clouds, atmospheric boundary layer dynamics, coupled balance of moisture and energy, soil moisture and climate feedbacks, hydroclimatology, monsoonal flow and thunderstorms. Emphasis on recent research and modern methods for data analysis and modeling.

Suggested Textbook: Physical Hydrology (Lawrence Dingman) ISBN – 0-13-099695-5.
Reference: Atmospheric Science: An introductory Survey by J. Wallace and P. Hobbs,
Academic Press.
The Atmosphere, Lutgens, Tarbuck and Tasa, 10th Edition. Prentice Hall

Faculty Coordinator: Faisal Hossain, Associate Professor of Civil Engineering
Participating Faculty: David Huddleston, Alfred Kalyanapu, Lenly Weathers and Dennis George

Prerequisites: CEE 4420(5420) Engineering Hydrology or consent of instructor

Goal: The goal of CEE 6440 “Hydrometeorology” is to introduce students to land atmosphere interaction that dictate the dynamics of the water cycle.

Course learning objectives:

- 1) To provide a detailed background of meteorological processes involving precipitation, lifting, atmospheric stability, radiation and teleconnections and to help students achieve a more holistic view of hydrology that incorporates meteorology.
- 2) To gain factual knowledge on mathematical modeling of surface hydrologic processes comprising runoff, evapo-transpiration, stream flow, infiltration and ground water flow.

Major Topics Covered:

1. The water cycle
2. Earth’s Radiation budget
3. Atmospheric processes – stability, lifting, adiabatic/pseudo adiabatic cooling, pressure-temperature-humidity relationships
4. Reynolds Transport Theorem
5. Precipitable water and T-storm model
6. Precipitation process – general concepts
7. Teleconnections, climate and weather
8. Mesoscale convective rainfall systems
9. Surface hydrology – Evapo-transpiration, infiltration, overland flow and channel flow
10. Mathematical modeling of the rainfall-runoff process
11. Case studies on hydrometeorologic controls on weather and climate

Measurable outcomes:

Students will be expected to:

1. estimate radiation budget at a given location and time of the year
2. be able to identify stability (conditional, unconditionally stable, unstable) of an air parcel
3. understand the major lifting mechanisms in precipitation formation
4. be able to track the temperature and humidity of an air parcel during orographic lifting
5. understand basic concepts of precipitation formation in mid-latitude and subtropical climates
6. understand the practical importance of teleconnected phenomena such as ENSO.
7. be able to physically model ET, infiltration, overland flow and channel flow for a catchment
8. understand the art and science of rainfall-runoff modeling and identify the iterative modeling process to develop the right hydrologic model
9. be able to apply Reynolds Transport Theorem for calculating precipitable water.

Table 1 - Frequency of offering for CEE graduate courses during 2008-2012 (*Core courses)

	Course Name	F08	S09	F09	S10	F10	S11	F11	S12
STRUCTURAL ENGINEERING	CEE 7610* Finite Element Analysis I		X		X		X		X
	CEE 5130 Matrix and Finite Element Methods			X		X		X	
	CEE5190 Advanced Mechanics of Materials	X		X		X		X	
	CEE 5350 Advanced Structural Design			X		X		X	
	CEE 5360 Advanced Topics in Structural Concrete Design	X		X		X	X		X
	CEE 5380 Bridge Design		X		X		X		X
	CEE 5700 Masonry Design				X		X		X
	CEE 7720 Fiber-Reinforced Composite Materials				X		X		
	CEE 7810 Structural Dynamics	X				X		X	
ENVIRONMENTAL/WATER RESOURCES	CEE 6520* Open-Channel Hydraulics	X			X			X	
	CEE 6610-20* Applied Environmental Chemistry	X		X		X		X	
	CEE 5410 Solid & Hazardous Waste Management					X		X	
	CEE 5500 Construction Management		X		X		X		X
	CEE 5450 Water Quality Modeling	X		X					
	CEE 5420 Engineering Hydrology	X		X		X		X	
	CEE 5430 Environmental Engineering				X				
	CEE 5440 Water Resources Engineering		X		X		X		X
	CEE 6040 Intermediate Fluid Mechanics			X					
	CEE 6420 Fluvial Hydraulics		X						
	CEE 6430 Probabilistic Methods in Hydrosience	X							X
	CEE 6440 Hydrometeorology					X			
	CEE 6710 Environmental Engineering Unit Operations and Processes - 1	X		X		X		X	
	CEE 6720 Environmental Engineering Unit Operations and Processes - 2		X		X		X		X
	CEE 6770 Environmental Engineering Laboratory		X	X		X			
CEE6840 Environmental Applications of Remote Sensing			X					X	

	Course Name	F08	S09	F09	S10	F10	S11	F11	S12
TRANSPORTATION/MATERIALS	CEE 6300* Composition and Properties of Concrete	X		X		X		X	
	CEE 6470* Transportation Demand Analysis	X	X	X		X		X	X
	CEE 6410* Traffic Control Systems				X				X
	CEE 5600 Civil Engineering Materials		X		X		X		
	CEE 5610 Pavement Design	X		X		X		X	
	CEE 5630 Traffic Engineering			X				X	
	CEE 5640 Highway Engineering		X		X		X		X
	CEE 7420 Public Transportation						X		
	CEE 5660 Transportation Planning	X		X		X		X	
	CEE 7410 Advanced Travel Demand Modeling	X							
	CEE 5930 Noise Control						X		
	CEE 7450 Topics in Concrete Durability						X		X
STRUCTURAL MECHANICS	CEE 7610* Finite Element Analysis I		X		X				X
	CEE 6930* Theory of Elasticity	X		X		X		X	
	CEE 7100 Advanced Computational Methods in Engineering		X			X			X
	CEE 7510 Theory of Plates and Shells							X	
	CEE 7620 Finite Element Analysis II			X		X		X	
	CEE 7720 Fiber Reinforced Composite Materials				X				X

Table 2 - List of new graduate courses designed and offered during 2002-2012 by CEE faculty

Course Name	Area of Specialization	Year First Offered	Justification/Purpose
CEE6520-Open Channel Hydraulics	Water Resources	2011 (reintroduced by new faculty)	Core course in water/environmental specialization. Course reincarnated by new hire faculty (Kalyanapu in Fall 2011) to provide greater emphasis on high resolution computational modeling.
CEE 6420-Fluvial Hydraulics	Water Resources	1999	Provides a modern perspective to river management through a multi-disciplinary approach involving hydraulics and river morphology
CEE 6430-Probabilistic Methods in Hydrosiences	Water Resources	2004	Provides an introduction of stochastic theory application to water resources engineering. Helps students understand the meaning of a random process.
CEE6440 Hydrometeorology	Water Resources	2005	Provide a more in-depth and holistic understanding of the global water cycle. Introduce students to emerging water measurement technologies like remote sensing and satellites
CEE7420 Urban Public Transportation	Transportation	2005	Provides for advanced study into urban public transportation issues and planning. At the time, none of the listed courses addressed this.
CEE 7910 Study of Current Literature in Engineering Mechanics.	Structural Mechanics	2007	Creates a formal atmosphere for faculty and students to study new and emerging topics that have been reported in the literature
CEE 7360 Advanced topics in Prestressed Concrete Design	Structural Engineering	2004	New course -- Graduate students majoring in structures need to learn advanced topics in structural design. This addition meets the needs of graduate students for advanced study in structural engineering.
CEE 5350 Advanced Structural Design	Structural Engineering	2002	The Advanced Structural Design course has been partially redesigned based on the new American Institute of Steel Construction (AISC) Manual of Steel Construction, Thirteenth Edition.
CEE 5380 Bridge Design	Structural Engineering	2002	The bridge design course has been fully redesigned to follow the new American Association of State Highway and Transportation Officials Load and Resistance Design Specifications

			(AASHTO LRFD). The revision of the course content is necessary because Federal Highway Administration mandates that all state DOTs have to use the AASHTO LRFD in 2007.
CEE 6900 Durability of Cement-Based Materials	Materials	2007	Students acquire knowledge of durability issues regarding the US deteriorating infrastructure and means to mitigate such damage. State-of-the-art topics were introduced through case studies.
CEE 6410 – Advanced Traffic Control	Transportation	2007	Entire course re-developed to match state of the practice.
CEE 6300 Multi-Scale Analysis of Concrete	Materials	2007	Changed from Composition and Properties of Concrete. The name change reflects the course content as taught by the current faculty. There is an emphasis on the nano-, micro-, and macro-scale behavior of Portland cement concrete and its related components.
CEE 5600 Civil Engineering Materials II.	Materials	2008	Change is course description changed to reflect change is topics to benefit students. The course description will now read: Design and testing of High-strength PCC, self-consolidating PCC, high volume fly ash PCC and pervious PCC. Controlled low-strength materials. Concrete formwork design. Masonry materials evaluation. Aggregate production and improvement.
CEE6480 (6900)-Environmental Applications of Remote Sensing	Water Resources	2009	This course was added because of increasing importance of remote sensing in the field of environmental and water resources management. Students acquire knowledge on the state of the art of remote sensing for estimating water variables from ground and space platforms. Applications are stressed.
CEE 6300 Multi-Scale Analysis of Concrete	Materials	2009	The current laboratory sessions are primarily computer based, which does not require a separate lab component. The labs will be retained as part of the course and will be incorporated into the lectures for the course. Students will still be required to perform the exercises, which will now be considered outside assignments.

CEE 5410 Solid and Hazardous Waste Management	Water Resources	2010	The prerequisite changed from CEE 3420 to CEE 3413 or consent of instructor in order to give the student more flexibility to enroll as soon as they had the knowledge to successfully continue the work in CEE 4410.
CEE 6950-60 Graduate Seminar	All disciplines	2010	This was an inactive course and the faculty voted to delete it.
CEE 6910 CEE Graduate Seminar	All disciplines	2010	CEE6910 was introduced for a more meaningful experience for CEE graduate students. In this course, experts in various fields of Civil Engineering are invited to deliver seminars and expose CEE graduate students to the state of the art. However, the most unique and key feature of this course, unlike typical graduate seminar courses, is a 3 week long orientation for new graduate students. In this orientation, students are exposed to plagiarism avoidance, research proposal/grant writing, literature review, rules/regulations set by graduate school and various tips to be successful.
CEE 7450 Advanced Topics in Concrete Durability	Materials	2011	This is for advanced graduate level work requiring strong background knowledge of cement-based materials. There are currently no transportation materials courses offered at the 7000-level; therefore this course will strengthen the course offerings for CEE doctoral students.
CEE 6480 – Environmental Applications of Remote Sensing	Water Resources	2011	This was a Special Topics during Fall 2009. The course is changed to remote sensing because there is no graduate level remote sensing course on campus tailored to environmental and water resources applications.
CEE 6200 Statistical Methods for Engineers	All disciplines	2012	This was formerly ISE 6200. Due to the integration of the ISE department and faculty into other engineering units, ISE courses must also be integrated. The faculty who teach ISE 6200 are now in the CEE department.

Table 3. Summary of non-CEE courses (co-curriculum) taken by CEE students by Department and emphasis area.

Department and Course Name	Emphasis Area			
	Environment/ Water	Structural Engineering	Transportation /Materials	Structural Mechanics
Earth Sciences				
GEOG5210- Cartography			X	
GEOG5510-Theory of GIS-I	X		X	
GEOG-GIS-II	X			
GEOG5650- Environmental Applications of GIS	X			
GEOL5711- Hydrogeology	X			
GEOG5850 – Advanced GIS			X	
Industrial Systems Engineering				
ISE6200- Probability and Statistics			X	
Statistics				
STAT5410- Statistical Methods-II			X	
Mechanical Engineering				
ME5510- Aerodynamics		X		X
ME6010 – Conduction Heat Transfer				X
ME6360 – Introduction to Continuum Mechanics		X		X
ME5060 – Machine Vibrations		X		
ME6050 – Convection Heat Transfer	X			
ME7090 - Computational Fluid Dynamics	X			
ME7100 – Turbulence	X			
Mathematics				
MATH5510 – Advanced Math for Engineers		X		X
MATH5470–Probability and Statistics-I	X		X	
MATH6170–Experimental Design	X	X		
MATH6510-Finite Difference Solution				X
MATH6070-Applied Statistical Methods-I			X	X
MATH6080–Applied Statistical MethodsII	X		X	
Biology				
BIOL5130 – Environmental Microbiology	X			
BIOL5840-Limnology	X			