George Mason University
Graduate Course Approval/Inventory Form

Please complete this form and attach a copy of the syllabus for new courses. Forward it as an email attachment to the Secretary of the Graduate Council. A printed copy of the form with signatures should be brought to the Graduate Council Meeting. Complete the Coordinator Form on page 2, if changes in this course will affect other units.

Please indicate: ___X_ **NEW** ____ **MODIFY** ____ **DELETE**

Local Unit: SCS **Graduate Council Approval Date:**

Course Abbreviation: EOS **Course Number:** 725

Full Course Title: Advanced Hydrosphere

Abbreviated Course Title (24 characters max.): Advanced Hydrosphere

Credit hours: 3 **Program of Record:** ESS M.S. and CSI Ph.D.

Repeatable for Credit?
___ D=Yes, not within same term Up to hours
___ T=Yes, within the same term Up to hours
_X_ N=Cannot be repeated for credit

Activity Code (please indicate): _X__ Lecture (LEC) ___ Lab (LAB) ___ Recitation (RCT)
___ Studio (STU) ___ Internship (INT) ___ Independent Study (IND) ____ Seminar (SEM)

Catalog Credit Format 3: 3: 0 **Course Level:** GF(500-600) ____ GA(700+) _X___

Maximum Enrollment: 10 **For NEW courses**, first term to be offered: Spring 05

Prerequisites or corequisistes: Two semesters of calculus (partial differential equations recommended) or permission of instructor

Catalog Description (35 words or less) **Please use catalog format and attach a copy of the syllabus for new courses:** This course uses mathematical and modeling approaches to present students with an in-depth study of the different components and transfer processes operative within the hydrosphere. Topics covered include the transfer processes relevant for oceans, lakes, rivers, snow, ice, glaciers, soil moisture, ground water, and atmospheric water vapor.

For MODIFIED or DELETED courses as appropriate:
Last term offered: Previous Course Abbreviation: Previous number:

Description of modification:

APPROVAL SIGNATURES:
Submitted by: _____ email: _____

Department/Program: _____ Date: _____

College Committee: _____ Date: _____

Graduate Council Representative: _____ Date: _____

GEORGE MASON UNIVERSITY
Course Coordination Form

Approval from other units:

Please list those units outside of your own who may be affected by this new, modified, or deleted course. Each of these units must approve this change prior to its being submitted to the Graduate Council for approval.

Unit:	Head of Unit's Signature:	Date:
Unit:	Head of Unit's Signature:	Date:
Unit:	Head of Unit's Signature:	Date:
Unit:	Head of Unit's Signature:	Date:
Unit:	Head of Units Signature:	Date:

Graduate Council approval: _____ Date: _____

Graduate Council representative: _____ Date: _____

Provost Office representative: _____ Date: _____

Course proposal to the Graduate Council
by
The School of Computational Sciences

1. CATALOG DESCRIPTION

EOS 725 Advanced Hydrosphere

Prerequisites: EOS 656 and three semesters of calculus (partial differential equations recommended) or permission of instructor.

Catalog description:

This course provides an in-depth examination of the spatial and temporal variations of the components and the transfer processes within the hydrosphere from an observational and modeling perspective. The hydrosphere includes the oceans, lakes, rivers, snow, ice, glaciers, soil moisture, ground water, and atmospheric water vapor.

2. COURSE JUSTIFICATION

Course objectives: To provide the physical principles of the Hydrosphere from the mathematical and modeling perspectives.

Course necessity: Currently, we do not have a course in ESGS program covering the subject in an advanced level. Students emphasizing in Earth Systems Science or Hydrology will need this advanced course for modeling.

Course relationship to Exiting Programs: The course will serve as the second course of the two-course sequence in hydrosphere meeting the need of students in MS in ESS and also Ph.D. in CSI. There are no significant overlaps between the proposed course and existing courses in EOS.

Course relationship to Other Existing Courses: No such course is offered in the GMU community. The course can be taken by other students in CSI Ph.D. , MS in ESS, and MS in Geography programs interested in hydrology and Earth Sciences.

3. APPROVAL HISTORY NA

4. SCHEDULING AND PROPOSED INSTRUCTORS

Time of initial offering: Spring 05

Proposed instructors: Drs. Long Chiu, Barry Klinger

Tentative syllabus: See attached syllabus

EOS 725 Advanced Hydrosphere (3:3:0)

Instructors:
Long Chiu ST-1 Rm 211, lchiu@gmu.edu, Tel: 703-993-1984
Barry Klinger, bklinger@mason.gmu.edu, Tel: 301-902-1271

Course Description: This course provides an in-depth examination of the spatial and temporal variations of the components and the transfer processes within the hydrosphere from an observational and modeling perspective. The hydrosphere includes the oceans, lakes, rivers, snow, ice, glaciers, soil moisture, ground water, and atmospheric water vapor.

Prerequisites: EOS 656 and three semesters of calculus (partial differential equations recommended) or permission of instructor.

Syllabus

The hydrosphere
- Overview of global hydrological components
- Conservation laws

Energy and Water Cycle
- Radiation in the Atmosphere
- The global energy cycle
- Simple energy balance model

Global hydrological cycle
- A little Planetary fluid dynamics
- Properties of a fluid at rest: hydrostatics
- Properties of a fluid in motion: hydrodynamics
- Effects of rotation
- Convection and turbulence

Atmospheric Water budget: water vapor

Precipitation
- Process, spatial and temporal distribution
- Estimation techniques and error
- Statistical concepts in space/time estimation

Evaporation and Runoff
- Process, spatial and temporal distribution
- Estimation and Data Sets

The oceanic mixed layer
- Properties of sea water
- Temperature, salinity, mixing
- Equation of state
- The Ekman layer

Large-scale circulation of the oceans
- Wind driven ocean circulation
- Thermohaline circulation and formation of water masses
- Fresh water effect on ocean circulation
- Transport of fresh water and heat

Chemistry of the oceans
- Chemical composition of sea water
- Phytoplankton

Effects on chemical state of ocean
Carbonates, clays and exchange reactions, CCD
Ocean/atmospheric exchange of gases, e.g. CO2 Ocean and life

Snow and Soil Moisture
Snowpack, snowmelt and
Soil moisture and surface/atmosphere exchange
Evaporation and transpiration

Fresh Water
Surface, stream water
Ground water infiltration and transport
Rainfall-runoff
Catchment hydrology
Flood and drought

Cryosphere
Glaciers
Sea ice
Polar energy balance
Albedo-temperature feedback

Short term variability and long term changes
Climate variations due to ocean/atmosphere/land interactions
Long-term changes in oceanic circulation
Sudden changes, e.g., the Younger Dryas
Anthropogenic forcing, e.g. CO2 and pollution

Reference Text

Dingman, S. Lawrence, 2002: Physical Hydrology, Prentice Hall, 646 pp.
Browning, K. A. and R. J. Gurney, Editors, 1999: Global energy and water cycles, Cambridge Press, 292 pp.
Other journal articles

Grade: 80% will be based on 1) an original research project report of 25 pages or more double-spaced. The quality should be publishable in JGR or similar journals, and 2) 20% on class participation and presentation of research progress.