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  ____X____ 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 corequisites: 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.

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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
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.