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Utah State University
Specialization in Geomorphology & Earth Surface Processes
CIP Code: 03.0205

Section I: Request

The Departments of Geology and Watershed Sciences at Utah State University both seek to add a “Geomorphology & Earth Surface Processes” specialization to their respective MS and PhD degrees in Geology and Watershed Science. No instructional activities will be impacted, as courses to be used for the requested specialization are already offered.

Section II: Need

The MS and PhD degrees in Watershed Science currently offer no specialization in geomorphology in spite of the depth of faculty expertise in this area. Both the Geology & Watershed Sciences departments have several faculty with research interests in this area, and a common specialization would strengthen the linkages between the departments/colleges and could allow students to become more interdisciplinary in their research interests. The “Geomorphology & Earth Surface Processes” (GESP) specialization will prepare students for careers in research, monitoring, management and restoration of land surfaces with a particular emphasis on the processes that shape landscapes across multiple scales. Course offerings in this specialization will include a) foundational knowledge, b) essential analytical, laboratory and field methods and skills, and c) application to topical challenges to land management, ecosystem recovery and stream/river restoration. A depth of foundational knowledge will be emphasized through geology, hydrology, fluvial geomorphology, fluvial hydraulics and hillslope geomorphology. A rich range of courses offered in Geology and Watershed Sciences, and other programs across the University (e.g. Ecology, Soils, Climate, Civil & Environmental Engineering, etc.) will fulfill the requirements of the specialization and build a breadth of understanding and interdisciplinary perspective among participating students.

Section III: Institutional Impact

The proposed change will not affect enrollments in the instructional programs of the two lead departments or of affiliated departments or programs, nor will administrative structures be affected. Two recent faculty hires in the Department of Watershed Sciences are teaching the additional courses as part of their role assignments. Faculty in the Geology Department presently teach courses that will support this specialization.

Section IV: Finances

No additional costs or savings are anticipated from this change.

Section V: Program Curriculum

All Program Courses

The GESP specialization requirements are designed to allow for flexible programs of study tailored to each student's needs and interests relative to their past experience. The minimum University and Departmental Degree requirements for the respective Department's graduate degree will be met. In addition to those requirements (but a part of the total credit requirement for each degree), the GESP specialization requires a core-set of foundational coursework in i) hydrology, ii) geomorphology and iii) analytical and computational skills. If a student has previously taken coursework or has relevant experience in these depth requirement areas, the student's supervisory committee may waive or substitute these requirements as they see fit.

DEPARTMENT SPECIFIC TRACK REQUIREMENTS (1 – 3 CREDITS)

Students must fulfill the requirements specified for their departmental degree in addition to specialization requirements.

For Watershed Sciences students this includes:

- WATS 6800/7800 – Watershed Sciences Departmental Seminar – 1 (F/Sp)
- WATS 6250 – Watershed Sciences Graduate Induction Course - 1 (F)

For Geology students this includes:

- GEO 6100/7100 – Graduate Seminar in Geomorphology - 1-3 (F)

CORE REQUIREMENT (9 CREDITS)

Students with this specialization must demonstrate proficiency in three core areas: hydrology, geomorphology, and analytical/computational methods. Students must take at least three courses from this list of core courses. In general, students are expected to take one course in each of these core areas. The student's Supervisory Committee may modify this requirement based on the student's past coursework and/or experience and select any three courses that will best address the specific student's deficiencies.

ELECTIVES

It is recommended that students choose electives from the Electives list below or from the core requirement list as electives that are not used to meet their core requirement.

	Course Prefix, Number and Title	Credit Hours
Department Requirements	Department of Watershed Sciences Students	
	WATS 6800/7800 – Watershed Sciences Seminar	1
	WATS 6250 – Watershed Sciences Graduate Induction	1
	Department of Geology Students	
	GEO 6100/7100 – Graduate Seminar in Geomorphology	1-3
	Sub-Total	1-3
Courses to Fulfill Core Requirements	i. Hydrology Requirement	
	WATS 5490 - Small Watershed Hydrology (Sp)	4
	CEE 6400 - Physical Hydrology (F)	3
	ii. Geomorphology Requirement	
	WATS 6150 - Fluvial Geomorphology (F)	3
	WATS 5670- Sediment Transport in Stream Assessment & Design (Su)	2
	GEO 6120/7120 – Advanced Geomorphology (Sp)	3
	iii. Analytical & Computational Methods Requirement	
	GEO 6540 – Quantitative Methods in Geology (F)	3
	GEO 6800/7800 – Graduate Seminar (F/Sp)	1-6
	WATS 6003 - Remote Sensing of Land Surfaces (Sp)	4
	WATS 6850* - Geomorphic Change Detection (Su)	1
	WATS 6900 – River Bathymetry Toolkit (Su)	1
	WATS 6900 – Graduate Special Topics (F/Sp)	1-6
	WATS 6920 – Advanced GIS & Spatial Analysis (Sp)	3
	WILD 6900 - GIS Programming with Python I (Sp)	1
	WILD 6740 - Physical Processes in Remote Sensing (Sp)	3
	WILD 6750 - Applied Remote Sensing (F)	3
Sub-Total	9 (min)	
Elective Courses	Potential Electives (organized by Department)	
	BIOLOGY	
	BIOL 6010 – Biogeography (Sp)	3
	BIOL 6020 – Modeling Biological Systems (F)	3
	BIOL 5030 – Individual-Based Models in Ecology & Evolution (F)	3
	BIOL 6050 - Programming & Database Management for Biologists II (F)	3
	CONTINUED ON NEXT PAGE	

Course Prefix & Number	Title	Credit Hours
Elective Courses	Potential Electives CONT. (organized by Department)	
	CIVIL & ENVIRONMENTAL ENGINEERING	
	CEE 6003 – Remote Sensing of Land Surfaces (Sp)	4
	CEE 6440 – Geographic Information Systems in Water Resources (F)	3
	CEE 6450 - Hydrologic Modeling (Sp)	3
	CEE 6470 – Sedimentation Engineering (Sp)	3
	CEE 6490 - Integrated River Basin/Watershed Planning & Management (Sp)	3
	CEE 6520 - Applied Hydraulics (F)	3
	CEE 6590 – Evaluation of Hydrologic Modeling Systems (Sp)	3
	CEE 7430 - Stochastic Hydrology (Sp)	3
	ENVIRONMENT & SOCIETY	
	ENVS 6320/7320 – Water Law & Policy in the United States (Sp)	3
	ENVS 6530 – Natural Resources Administration (F)	3
	GEOLOGY	
	GEO 5510 – Groundwater Geology (F)	3
	GEO 6540 – Quantitative Methods in Geology (F)	3
	GEO 5630 - Photogeology and Image Analysis (Sp)	3
	GEO 6100/7100 – Graduate Seminar in Geomorphology (F)	1-6
	GEO 6520 – Techniques in Groundwater Investigations (Sp)	3
	GEO 6880 – Paleoclimatology (SP)	3
	GEO 6100/7100 – Graduate Seminar in Geomorphology (F)	1-3
	GEO 6120/7120 - Advanced Geomorphology (SP)	3
	GEO 6250/7250 - Mechanics & Process in Earth Science (SP)	3
	GEO 6660 – Applied Geophysics (Sp)	4
	GEO 6800/7800 – Graduate Seminar (F/Sp)	1-6
	GEO 6970 – Thesis Research	
	GEO 7970 – Dissertation Research	
	MATHEMATICS	
	MATH 5620 – Numerical Solution of Differential Equations (Sp)	3
	MATH 5670 – Stochastic Processes (F)	3
	PLANT SOILS AND CLIMATE	
	PSC 6130 - Soil Genesis, Morphology, and Classification (F)	4
	PSC 5670/6670 - Environmental Soil Physics (F)	4
	PSC 7210 - Advanced Topics in Pedology (Sp)	2
	SOCIOLOGY	
	SOC 6620 – Environment, Technology & Social Change (Sp)	3
	SOC 6630 – Natural Resources & Social Development (Sp)	3
	SOC 6640 – Conflict Management in Natural Resources (Sp)	3

Course Prefix & Number	Title	Credit Hours
Elective Courses	Potential Electives CONT. (organized by Department)	
	STATISTICS	
	STAT 5100 – Linear Regression & Time Series (F)	3
	STAT 5200 – Design of Experiments (Sp)	3
	STAT 5600 – Applied Multivariate Statistics (Sp)	3
	STAT 6180 – Time Series (Sp)	3
	STAT 6410 – Applied Spatial Statistics (F)	3
	WATERSHED SCIENCES	
	WATS 6150 - Fluvial Geomorphology (F)	3
	WATS 6170 - Fluvial Geomorphology Lab (F)	2
	WATS 5200 - Fish Habitats (F)	2
	WATS 5490 - Small Watershed Hydrology (Sp)	4
	WATS 5640/7640 - Riparian Ecology and Management (Sp)	3
	WATS 5670 - Sediment Transport in Stream Assessment & Design (Su)	2
	WATS 5660 - Watershed and Stream Restoration (Su)	2
	WATS 5670 - Watershed and Stream Restoration Practicum (Su)	2
	WATS 5680/6880 - Paleoclimatology (Sp)	3
	WATS 6003 - Remote Sensing of Land Surfaces (Sp)	4
	WATS 6250 - WATS Graduate Induction Course (F)	1
	WATS 6520 - Applied Hydraulics (Sp)	3
	WATS 6740 - Remote Sensing: Modeling & Analysis	3
	WATS 6850* - Geomorphic Change Detection (Su)	1
	WATS 6900 – Fluvial Hydraulics & Ecohydraulics (Sp)	2-3
	WATS 6900 - Partnering with Beaver in Restoration Design (F)	1
	WATS 6900 - River Bathymetry Toolkit (Su)	1
	WATS 6900 - Graduate Special Topics	1-5
	WATS 6920 - Advanced GIS & Spatial Analysis (Sp)	3
	WATS 6921 - GIS Research Projects (Sp)	2
	WATS 6970 - Thesis Research	
	WATS 7970 - Dissertation Research	
	WILDLAND RESOURCES	
	WILD 6350 - Wildland Soils (Sp)	3
	WILD 6510 - Topics in Spatial Ecology (Sp)	1-3
WILD 6710/7710 - Landscape Ecology (Sp)	3	
WILD 6740 - Physical Processes in Remote Sensing (Sp)	3	
WILD 6750 - Applied Remote Sensing (F)	3	
WILD 6900 - GIS Programming with Python I (Sp)	1	
WILD 6900 - GIS Programming with Python II (Sp)	1	
	Subtotal (Electives)	Varies
	TOTAL REQUIRED	10-12

New Courses to Be Added in the Next Five Years

No new courses are needed for the specialization to meet the requirements outlined above. There is already flexibility within the above curriculum to offer courses as new topics within the GEO 6100/7100 (Graduate Seminar in Geomorphology), GEO 6120/7120 (Advanced Geomorphology), and WATS 6900 (Special Topics). If new courses are added, they will be listed as elective courses.

Program Schedule

The GESP specialization requirements are designed to allow for flexible programs of study tailored to each student's needs and interests relative to their past experience. In general, students should seek to complete:

- In First Year:
 - Departmental Requirements (1-3 credits)
 - Core Requirements
 - Elective(s) necessary to support their research
- In Second Year:
 - Complete or continue remaining electives
 - Research (Thesis/Dissertation)
- Third Year & Beyond (PhD)
 - Complete or continue remaining electives
 - Research (Thesis/Dissertation)