DEPARTMENT OF RIVER-COASTAL SCIENCE AND ENGINEERING

Programs

Undergraduate

Minor

- Civil Engineering-Water Resources and Environmental Minor (https://catalog.tulane.edu/science-engineering/river-coastal-science-engineering/civil-engineering-water-resources-and-environmental-minor/)

Graduate

Dual Degree Program

- Dual Degree in Master of Landscape Architecture / Master of Science in River and Coastal Engineering, MLAN/MS (https://catalog.tulane.edu/architecture/landscape-architecture/landscape-architecture-river-coastal-science-engineering-mlan-ms/)

Master of Science (Non-resident)

- Master of Science in River-Coastal Science and Engineering (Non-Resident) (https://catalog.tulane.edu/science-engineering/river-coastal-science-engineering/river-coastal-science-and-engineering-ms-non-residential/)

Master of Science (Resident)

- Master of Science in River-Coastal Science and Engineering (Resident) (https://catalog.tulane.edu/science-engineering/river-coastal-science-engineering/river-coastal-science-and-engineering-ms-residential/)

Doctor of Philosophy

- Doctor of Philosophy in River-Coastal Science and Engineering (Resident) (https://catalog.tulane.edu/science-engineering/river-coastal-science-engineering/river-coastal-science-and-engineering-phd/)

Certificate

- River-Coastal Science and Engineering Certificate (Graduate) (https://catalog.tulane.edu/science-engineering/river-coastal-science-engineering/river-coastal-science-and-engineering-certificate-graduate/)

Courses

River Coastal Science and Engineering (RCSE)

RCSE 1040 The Gulf Coast in 2100: Sustaining Healthy Ecosystems and Vibrant Community (3)
In the 21st century, Gulf Coast ecosystems, communities and economies are under unprecedented threat from the effects of a rapidly changing climate, compounded by pre-existing human and natural factors. This seminar-based course will use a diverse team of instructors and guest discussion leaders to outline the issues and challenges that are underway in the Gulf, and to explore solutions. A second goal will be to explore possible career and advocacy pathways for students to contribute to “Saving the Gulf Coast”.

RCSE 1660 Special Topics in River Coastal Science and Engineering (3)
Special Topics course for Undergraduates at the 1000 level.

Maximum Hours: 99

RCSE 2660 Special Topics in River Coastal Science and Engineering (3)
Special Topics course for Undergraduates at the 2000 level.

Maximum Hours: 99

RCSE 3660 Special Topics in River Coastal Science and Engineering (3)
Special Topics course for Undergraduates at the 3000 level.

Maximum Hours: 99

RCSE 4010 Water Resources Engineering II (3)
This course covers the basic principles of flow in open channels, open channel transitions, pumping system (water and wastewater), flow through hydraulic structures, and drainage analysis. It also includes hydraulics of flow in closed conduits, municipal water distribution systems. The laboratory section of this course focuses on flow measurements and non-uniform flow analysis: e.g., flow over a weir, hydraulic jump, losses through a pipe system, and flow visualization techniques.

Prerequisite(s): (RCSE 3010, BMEN 3440 or CENG 2320).

RCSE 4030 Water Resources Engineering III (3)
This course covers the basic principles of hydrologic science and their application to the solution of hydraulic, hydrologic, environmental, and water resources engineering problems; environmental restoration and protection techniques. Specifically, the course covers rainfall and catchment properties, hydrologic abstractions, hydrologic measurements, small and midsize catchments hydrology, reservoir routing, hydrologic and hydraulic routing.

Prerequisite(s): RCSE 3010 or CENG 2320.

RCSE 4100 Introduction to AI in Civil and Environmental Engineering (3)
This course introduces the principles and applications of artificial intelligence (AI) in civil and environmental engineering. Students will explore generative AI, AI-assisted programming, data management, environmental data analysis, geospatial analysis, and visualization techniques through hands-on labs and lectures. Special emphasis will be placed on ethical considerations and career readiness through real-world case studies and project work.

RCSE 4660 Special Topics in River Coastal Science and Engineering (3)
Special Topics course for Undergraduates at the 4000 level.

Maximum Hours: 99

RCSE 6010 Water Resources Engineering I (3)
Static and dynamic behavior of incompressible fluids will be studied. The continuity, energy and momentum equations are developed using the control volume approach. Dimensional analysis, similitude and model testing laws are developed. Steady, incompressible fluid flow in series, parallel, and branching pressure conduits is studied. Turbulent and laminar boundary concepts will be presented. This course will have a compressed schedule (summer) and a substantial written component that supports integration into design studios.

RCSE 6020 Water Resources Engineering II (3)
This course covers the basic principles of flow in open channels, open channel transitions, pumping system (water and wastewater), flow through hydraulic structures, and drainage analysis. It also includes hydraulics of flow in closed conduits, municipal water distribution systems. The laboratory section of this course focuses on flow measurements and non-uniform flow analysis: e.g., flow over a weir, hydraulic jump, losses through a pipe system, and flow visualization techniques. A similar course is offered on the undergraduate level as RCSE 4010.

RCSE 6030 Water Resources Engineering III (3)
This course covers the basic principles of hydrologic science and their application to the solution of hydraulic, hydrologic, environmental, and water resources engineering problems; environmental restoration and protection techniques. Specifically, the course covers rainfall and catchment properties, hydrologic abstractions, hydrologic measurements, small and midsize catchments hydrology, reservoir routing, hydrologic and hydraulic routing. Graduate students will be given additional writing and presentation assignments.

RCSE 6040 Coastal Marine Geology (3)
Geomorphic features of estuarine, coastal, and continental shelf environments: erosional, depositional, and geochemical processes; field and laboratory methods; emphasis on dynamic coastal environments of the northern Gulf of Mexico.

RCSE 6050 Geospatial Data Collection and Analysis for Environmental Applications (3)
This advanced course delves into the applications of geospatial analysis and remote sensing technologies in river science, coastal engineering, and landscape architecture. Tailored for interdisciplinary programs, it integrates advanced Geographical Information techniques (GIS) techniques, drone-based data collection, and LiDAR technology to address environmental challenges and design sustainable solutions for riverine and coastal landscapes. Students will engage in hands-on projects, fieldwork, and collaborative exercises to develop the skills necessary for analyzing complex spatial data and making informed decisions in environmental planning and engineering.

RCSE 6100 Introduction to AI in Civil and Environmental Engineering (3)
This course introduces the principles and applications of artificial intelligence (AI) in civil and environmental engineering. Students will explore generative AI, AI-assisted programming, data management, environmental data analysis, geospatial analysis, and visualization techniques through hands-on labs and lectures. Special emphasis will be placed on ethical considerations and career readiness through real-world case studies and project work.

RCSE 6660 Special Topics (1-3)
Special Topics. Courses may be repeated up to unlimited credit hours.

Maximum Hours: 99

RCSE 6661 Special Topics (1-3)
Special Topics. Courses may be repeated up to unlimited credit hours.

Maximum Hours: 99

RCSE 6710 Open Channel Flow (3)
This course covers the principles of open channel hydraulics, and their applications for analysis and design of river channels. Specifically, the course covers open channels classifications and properties, computation of uniform flow, steady gradually varied flow, flow over hydraulic structures (spillways, weirs, gates, culverts, syphons, and pumps), hydraulic jump, flow characteristics in meandering rivers and nonprismatic channels, and unsteady flow. Pre-requisite: Permission of instructor.

RCSE 6800 Intro to River Science & Eng (3)
Rivers drain the majority of non-ice-covered land surfaces on Earth and are the primary conduit for freshwater, minerals, carbon, and dissolved ions to the global ocean. In the 21st century, rivers large and small are being increasingly managed for flood control, as a source of water (agricultural, industrial, potable), recreation and navigation, all of which can have system-wide environmental consequences. Future basin and global-scale climate changes must also be considered in management decisions. This course is designed to be a graduate and advanced undergraduate, interdisciplinary examination of river science and engineering practices that can serve as a springboard to more advanced coursework on the disciplinary aspects covered. It will also be useful to practitioners who require an interdisciplinary overview of river systems to more effectively perform their professional duties.

RCSE 6802 Introduction to Coastal Science and Engineering (3)
With approximately 3 billion people living within 200 kilometers of the world's coastlines, coastal regions are home to a large and ever-growing population. A broad engineering knowledge is fundamental for the construction, protection, and maintenance of these coastal communities, and a good scientific understanding of the main underlying physical, chemical and ecological processes is particularly necessary considering the climatic changes we are facing in the 21st century. This course is designed to be a graduate and advanced undergraduate, interdisciplinary examination of coastal science and engineering practices that can serve as a springboard to more advanced coursework on the disciplinary aspects covered. It will also be useful to practitioners who require an interdisciplinary overview of coastal systems to more effectively perform their professional duties.

RCSE 6810 River and Stream Restoration (3)
Rivers and streams are complex ecosystems which have interconnected geologic, geomorphologic, chemical and biological underpinnings. As the demands of human populations have increased over the past several centuries, rivers and streams have often been pushed beyond their ability to maintain the dynamic equilibrium inherent to the system. In recent decades, in an attempt to restore some of the values and functions to these systems, river and stream restoration has emerged as a multi-billion-dollar industry. This course will cover the definitions of river and stream restoration, discuss the planning process associated with solid restoration efforts, present restoration techniques, discuss environmental flows as restoration measures, present commonly applied design concepts and consider how uncertainty, monitoring, and adaptive management may be applied to river and stream restoration efforts.

Prerequisite(s): RCSE 6800 or SCEN 6800.

RCSE 6820 Introduction to River-Coastal Hydrologic and Hydraulic Modeling (3)
Numerical models are effective and informative research, design, and planning tools. The substantial advancement in computational power has allowed numerical models to be a viable and efficient tool to solve complex problems and improve our understanding of the fundamentals in the water resources field. Therefore, it is critical to provide an in-depth understanding of the basics of numerical modeling techniques and recognize the strengths and limitations of these techniques. This 3 credit hour graduate level introductory modeling course will provide general overview of the basics of numerical modeling, model development, and applications. This course will also include opportunities for the students to participate in hands-on applications to examine a research, design or a planning problem and explore ways where numerical models can provide usable information to answer or provide insights into these questions. Permission from instructor required to register.

RCSE 6830 River Mechanics & Management (3)
This course will provide a thorough understanding of the practical application of river mechanics. This science is a critical, but often overlooked component, of any river management project. The River Mechanics and Management course introduces the student to a wide range of river topics related to the engineering and management of river systems. This includes an advanced examination of fluvial processes, channel stability concepts, sediment transport, and design considerations for commonly used engineering features. The course will also provide instruction on designing structural elements to aid in the management of river channels and floodplain. The course will emphasize the interdisciplinary nature of river science and engineering.

Prerequisite(s): RCSE 6800.

RCSE 6840 Methods in River Sampling (3)
Tools and procedures developed for sampling and monitoring riverine systems over the last century are distinct from those developed for other aqueous environments. In addition to the need for tools tailored for systems of a wide range of size, energy, and setting, effective river monitoring also needs to capture highly episodic hydrographs that encompass large overbank areas during floods. River monitoring has profound implications in managing rivers for human use and for channel and riparian ecosystem health. Rivers are also highly sensitive to climate, and historical records of their behavior are a key indicator of changing climate on a basin and global scale. This course is designed to examine river sampling as conducted by agencies and academic researchers, including the use of remote sensing, and the collection of ecological, water chemistry, hydrological, sediment dynamics, and morphological evolution data sets. Historical data will be examined to define statistical data analytical procedures.

Prerequisite(s): RCSE 6800.

RCSE 6850 Estuarine Processes (3)
Estuaries, where rivers meet the ocean, are among the most productive and dynamic systems on earth, and they are valued for recreation, habitat, and navigation. They are often located in areas with large populations, frequently resulting in intense competition for resources. This class will be taught to convey basic concepts that are important in estuary dynamics. It will include an introduction to estuarine ecology, descriptions of the generation of tides, tie wave propagation within the estuary, the role of salinity and density currents, estuarine sedimentation and an overview of navigation concerns. An emphasis will be placed on understanding the relationships between ecological and physical systems. The class will provide an understanding of ecosystem impacts as a result of physical changes in the estuary. Numerical models are the standard approach for investigating estuary behavior and will be used as a construct to understand estuaries, but prior knowledge of modeling is not required.

Prerequisite(s): RCSE 6800.

RCSE 6860 Environmental Data Analysis in the Anthropocene (3)
Scientists, engineers, and planners are increasingly faced with the challenges of a changing environment. These changes can be climate change related – and associated with factors such as sea-level rise, droughts, or heavy precipitation – or result from more local human overprints of the natural landscape (e.g., changes in land use, dredging of rivers, flood protection measures). But they all require, more than ever, tailored data analysis tools to capture transient behaviors, non-stationarity, and new equilibria. This class equips students with the probability, data, and time series analysis tools that they need to interpret a wide range of environmental data - from lab measurements to field observations. The successful completion of MATH 1210 and MATH 1220 and PHYS 1310 and 1320 or permission of the instructor is required for registration.

RCSE 6865 Sea-Level Change (3)
In this course we will investigate how sea levels have been changing geologically (as indicated by proxies), more recently (as tracked by in-situ measurements and modern remote sensing techniques) and how they will change in the future (as predicted by models calibrated against past periods). We will assess their physical causes and discuss the diverse consequences, impacts, and adaptation options for our coasts.

RCSE 6870 Hydroclimatology (3)
The course will cover four major themes and their specific methods. First, we will review the physical processes behind precipitation, cloud formation, and hydrological partitioning at small hydrological scales (small catchments and sub-basins) to understand how climate influences and is influenced by energy and water exchange at the planet's surface. Then, we will discuss how land use and coverage changes affect hydro-climatological processes at the regional scale (the size of the Mississippi River basin and a bit below) and how to measure the magnitudes of these changes via micro-meteorological techniques. At the larger synoptic scales, we will learn how climatic modes of variability – like ENSO – influence the hydroclimate. Finally, we will review probabilistic and stochastic methods to estimate hydrologic change from data and project the future with a resilient hydraulic infrastructure in mind. The successful completion of MATH 1210 and MATH 1220 and PHYS 1310 and 1320 or permission of the instructor is required for registration.

RCSE 6875 Ecohydrology (3)
This course will explore the relationship between the biosphere and the hydrologic cycle at various spatial and temporal scales. The focus will be on understanding how water moves across soil, plants, and the atmosphere and how ecohydrological processes can be modeled and measured. We will also explore how ecosystems impact climate and water availability through land-atmosphere interactions. Finally, we will examine how plant-water relationships can influence the structure of ecosystems. The successful completion of MATH 1210 and MATH 1220 and PHYS 1310 and 1320 or permission of the instructor is required for registration.

RCSE 6900 Independent Study (1-3)
Independent study on a research topic of choice under the direction of a faculty member.

Maximum Hours: 99

RCSE 7020 Research Skills, Information Literacy and Scientific Writing (3)
This course will introduce students to library research skills, understand more about the structure and components of scientific documents and the skills needed to efficiently read scientific articles. These skills will be used to write and practice writing, review and critique scientific documents. Students will enter the class with a 1-2 page research plan approved by their advisor and use this information and the skills introduced in the class to create by the end of the semester a proposal describing their proposed research. For Masters students the proposal must be reviewed by their advisor and Graduate committee after the completion of the class. For PhD students, after approval by their advisor and graduate committee, the proposal can be used to fulfill the Tulane University School of Science and Engineering requirements for a dissertation prospectus as part of the application package for admission to candidacy. Students will also learn, review and create a high-quality scientific poster.

RCSE 7100 Seminar in River Coastal Science and Engineering (1)
Research seminars led by a speaker with external readings and discussions with the seminar speaker.

Course Limit: 3

RCSE 7940 Transfer Credit- Graduate (1-12)
Graduate Transfer Credit in River Coastal Science and Engineering.

Maximum Hours: 99

RCSE 8060 Advanced Standing (3)
Advanced Standing course: RCSE 6060

RCSE 9980 Masters Research (0-3)
Research toward completion of a master degree. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

RCSE 9990 Dissertation Research (0-3)
Research toward completion of a doctoral degree. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99