## Engineering School of Sustainable Infrastructure and Environment

**EOC 6934 –** "Mathematical models for riverine, estuarine and coastal geomorphology"

3 Credits – Spring 2019 – (modified on 11/28/2018)

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**Description:** This course will focus morphodynamic models and how they can be used for studying and predicting geomorphic processes in rivers, estuaries and coasts.

**Course goals:** By the end of the course, the students will have a good understanding of:

- which are the mathematical models used to predict the morphodynamic tendencies of a system, with a specific focus on the long term equilibrium;
- which are the dominant processes for a specific morphological system, and which ones can instead be neglected;
- which is the best model to use for a specific problem (aka: when 3D is good and when it is overkill);
- how to code from scratch simple morphodynamic models in Fortran.

**Lectures:** T,R (Tuesday and Thursday) | Period 8 - 9 (3:00 PM - 4:55 PM)

**Prerequisites**: none, but it is suggested to have a solid mathematical background.

**Final Exam:** To be defined.

**Instructor: Alberto Canestrelli**
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**Office hours:** Tuesday and Thursday 5 pm to 6 pm. If you plan to show up please let me know at the end of the class. By appointment I can accommodate other times.

**Text and Notes:** The student will be required to take notes in class, I would not follow any specific textbook. However, all the multimedia material which will be presented, as well as open source numerical codes, will be shared on canvas.

**Referenced texts:**

Roelvink, D. (2011), A Guide to Modeling Coastal Morphology, World Scientific Editions.
Savenije, H. H. G. (2012). "Salinity and tides in alluvial estuaries" (2nd ed.). New York: Elsevier.
Slingerland, R., and L. Kump (2011), Mathematical Modeling of Earth's Dynamical Systems. A Primer, 231 pp., Princeton Univ. Press, Princeton.

**Assignments**: Homework will be assigned approximately weekly and are due the following

week.

**Grading:** Exams – 2 = 60%
Assignments = 20%
Project = 20%

Final letter grades will be assigned based on the following scale.

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| A | 100-90% |
| B | 89-80% |
| C | 79-70% |
| D | 69-60% |
| E | 59-0% |

**Late work: for each assignment/project turned in late, 2% will be removed from the final grade. If it more than 5 days late, 5% will be removed. For 10 days or more, 20% will be removed.**

**Accommodations for Students with Disabilities:** Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the instructor when requesting accommodation.

**Course Outline:**

- Introduction: why do we study geomorphology?
- Starting upstream: mathematical modeling of landscape evolution.
- Modeling of sediment transport in a water stream: general concepts
- Suspended transport for cohesive and non-cohesive sediments. Bedload transport.
- 3D advection-diffusion equation and 2D Exner equation. Description of different approaches and common simplifications.
- Bed forms and their impact on bed friction.
- Definition of morphodynamic equilibrium and its importance.
- Equilibrium slope of a river with constant grain size (fixed banks).
- Longitudinal equilibrium profile of a river with widening or narrowing cross section (fixed banks).
- Bank erosion and the equilibrium cross section of a straight river.
- Equilibrium cross-section at a river bend.
- The physics of river meandering.
- Modeling sediment transport and morphodynamics with multiple grain sizes: the active layer concept and stratigraphic bookkeeping.
- The long term longitudinal equilibrium of an estuary.
- The equilibrium cross section of a tidal channel
- What flanks tidal channels and creeks? The morphodynamic evolution of tidal flats and salt marshes.
- River mouth bars and modes of river delta progradation into a basin.
- Moving to the coast: the long term cross sectional evolution of a uniform beach.
- Coastline evolution models

## Note: this syllabus is subject to change; students who miss class are responsible for learning about any changes to the syllabus

### Commitment to a safe and inclusive learning environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination.

It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@ufl.edu

*Sexual Discrimination, Harassment, Assault, or Violence*

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu