BEE 446-546, River Engineering, Spring 2017

Instructor
Desiree Tullos, PhD, PE
Professor, Biological and Ecological Engineering Department
233 Gilmore Hall; Phone: 541.737.2038
desiree.tullos@oregonstate.edu
Office Hours: Wednesdays 3-5pm

Class meeting times and places: Tuesdays & Thursdays, 4-5:50pm in MLM 318

Course Description from catalog: Multipurpose river use; natural physical processes in alluvial rivers; channel modification practices; river structures; design practices; impact of river modification; problem analysis; and impact minimization. Offered alternate years.

Learning outcomes:
Upon completion of this course, all students will be able to:

- Make observations of and investigate hypotheses about river processes and the impacts of river engineering alternatives.
- Identify and justify appropriate engineering solutions.
- Analyze tradeoffs in designs with multiple objectives.
- Formally document analyses and design recommendations.
- Communicate professionally in design teams.
- Effectively use figures and graphs to communicate analysis results.
- Increase experience with and exposure to modeling systems.
- Apply model results in analysis of design alternatives.
- Identify model assumptions, sensitivity, and limitations.

Prerequisites: BEE 312, CE313 or with instructor permission

Required Text: None. All materials will be provided to students via Canvas.

Field trip information: We will have one field trip to the site of the design project. Please be prepared to be cold and wet or hot and dry. We will go out regardless of weather conditions. Depending on the weather, warm clothes, rain coat and pants, and boots that will keep your feet warm and dry may be necessary. Waders will be provided if the channel is wadable.

Slash course information: Students enrolled in BEE 546 will be considered project managers for the design teams. Project manager duties include: 1) submitting the “rules of engagement” to the Discussion board after discussion with group (graded), 2) fostering open and equal sharing of ideas and responsibilities throughout the term, 3) providing a mechanism for evaluating the
group process, and 4) ensuring that team members understand their individual roles and responsibilities, and execute their tasks in a timely and quality manner.

**Evaluation of student performance**

**Final group design project:** 40%

- Alternatives analysis (10%), final report (20%), peer evaluation (10%)
  - Appropriateness of motivation, data collection, methods, project analysis of alternatives, design details, justification and defense of assumptions, recommendations
  - Clarity and completeness of design report
  - Clarify and completeness of oral presentation
  - Peer evaluation of group process and performance

**Midterm Exam (18%).** The midterm will be based on lectures and in class examples, homework assignments, and reading discussions.

**Homework assignments (40%):** 8 assignments (5% each)

- Introductory survey (1%) and Rules of Engagement discussion (1%)

**Late assignments:** Due to the size and nature of the course, there is a strict late policy for this class: No assignments will be accepted late regardless of circumstance. However, I will drop the lowest homework assignment.

**University and Departmental Policies.**

**Students with Disabilities:** "Students with documented disabilities who may need accommodations, who have any emergency medical information the instructor should know, or who need special arrangements in the event of evacuation, should make an appointment with the instructor as early as possible, no later that the first week of the term. In order to arrange alternative testing, the student should make the request at least one week in advance of the test. Students seeking accommodations should be registered with the Office of Services for Students with Disabilities."

**Rules on Civility and Honesty:** The Biological and Ecological Engineering Department follows the university rules on civility and honesty. These can be found at: [http://studentlife.oregonstate.edu/code](http://studentlife.oregonstate.edu/code).
<table>
<thead>
<tr>
<th>Week</th>
<th>Theme</th>
<th>Reading assignment</th>
<th>Tuesday</th>
<th>Content</th>
<th>Thursday</th>
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<th>HW</th>
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<tr>
<td>1</td>
<td>Key concepts in River Engineering</td>
<td>Hamar et al. (2005)</td>
<td>4-Apr</td>
<td>Group assignments; Rules of engagement</td>
<td>6-Apr</td>
<td>Overview of river engineering and river processes - Lane's balance, flow resistance, streamlines; Discuss Hamar et al.</td>
<td>Review calcs</td>
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<td>2</td>
<td>Project introduction, design process, and monitoring</td>
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<td>11-Apr</td>
<td>1) Wrap up channel stability, discuss Hamar, example capacity calcs</td>
<td>13-Apr</td>
<td>Project requirements, HW #2, engineering design process, using models in engineering design, Monitoring for design and evaluation</td>
<td>Project field data collection plan and outline of analysis/design tasks</td>
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<td>3</td>
<td>Sediment entrainment</td>
<td>Lorang and Hauer (2003)</td>
<td>18-Apr</td>
<td>Sediment entrainment; Shear stress, shear velocity, Shields curve; Discuss Lorang and Hauer; Example calculations of competent flow; Using ShieldsDiagramDynamEqn.xls</td>
<td>20-Apr</td>
<td>1D and 2D sediment transport modeling (Catalina Sugura)</td>
<td>Channel stability below a hydropower station</td>
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<td>4</td>
<td>Bank processes and stabilization</td>
<td>Simon et al. (2000)</td>
<td>25-Apr</td>
<td>Bank processes and stabilization</td>
<td>27-Apr</td>
<td>Bank stability examples with BSTEM</td>
<td>Qualitative bank assessment at term project site and bank line mapping</td>
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<td>Engineered log jams</td>
<td>Doust and Millar (2000)</td>
<td>2-May</td>
<td>Large wood for bank stability and habitat</td>
<td>4-May</td>
<td>Habitat: definitions and restoration; Midterm review</td>
<td>ELJ design</td>
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<td>9-May</td>
<td>MIDTERM</td>
<td>11-May</td>
<td>HEC-RAS design lab</td>
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<td>7</td>
<td>Grade control - Step pools, rock ramps, and constructed riffles</td>
<td>Newbury et al (2013) or Walker 2004</td>
<td>16-May</td>
<td>Hydraulic controls at inlets and exist; Constructed riffles and step pools</td>
<td>18-May</td>
<td>HEC-RAS design lab</td>
<td>Hydraulic riffle design</td>
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<td>Dams, dam removal, and flood management</td>
<td>Doyle et al (2005); Schmidt and Wilcock (2008); Optional extra credit</td>
<td>23-May</td>
<td>Dams, reservoir operations, and flood mgnt</td>
<td>25-May</td>
<td>Fish passage design and permitting (Ken Loffink, ODFW)</td>
<td>Initial HEC-RAS model results</td>
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<td>9</td>
<td>Fish passage</td>
<td>FHWA (2012) Ch. 1.4 - Culvert hydraulics</td>
<td>30-May</td>
<td>Dam removal case studies</td>
<td>1-Jun</td>
<td>Columbia River Treaty and hydropower operations (John Hyde, BPA)</td>
<td>Using nomographs to design culverts</td>
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<td>10</td>
<td>Wrap up</td>
<td></td>
<td>6-Jun</td>
<td>Term project presentations</td>
<td>8-Jun</td>
<td>Term project presentations</td>
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