**HYD 198 – Water Science and Design**

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**Textbooks:**

- *Water Resources Engineering 3rd edition*, Chin, Prentice Hall (2012)
- *Design Hydrology and Sedimentology for small catchments.* Haan, Barfield and Hayes, Academic Press (1994) (not in library)
- *Soil and Water conservation Engineering 4th ed*. Schwab, Fangmeier, Elliot and Frevert, John Wiley & Sons, Inc. (1993) (Library: Phy Sci Engr Library TC409 .H3 1994 Regular Loan)

**References on Reserve:**

- *Design of small dams*, US Dept. of Interior, Bureau of Land Reclamation
- *Open Channel hydraulics*, Chow

**Lecture/Lab**

Tuesdays, Thursdays (10:30 am to 12 pm), Lab: Thursdays (1-4 pm)

**Course Description:**

The purpose of this course is to teach basic design and analysis ***as practiced*** for water control and nonpoint source pollution prevention. We will discuss the origins of design approaches including their theoretical bases but this is not a theory course. Many design methods have an empirical basis and simplifying assumptions, generally because extensive data requirements for more complex physically robust analyses are not readily available.

The first two weeks of this course cover applied hydrology and for some of you these initial weeks will be a partial review, but for others this will be a relatively intense period.

Most of the course will be dedicated to practicing applied design. There are two aspects receiving focused attention: 1) applying scientific and engineering principles and methods to create designs and 2) presenting work in concise organized reports. Most assignments will be representative of real-life engineering problems and will involve as much hands-on experience as possible.

Lab/seminar afternoon sessions will be used for problem-solving, data gathering, or field trips. Although the labs/seminars are scheduled for a 3-hr period often only the first 1 to 1.5 hours or so will be used, except for the off-campus field trips which will generally require the whole period.

For this course you will be graded on both your technical ability and the presentation of your ideas. ***Homework will be due 1 week after it is assigned. For each day late, 10% will be subtracted from your grade up to one week whereby the assignment will no longer be accepted.***

**Grade:**

50% Homework Assignments and Pop Quizzes
20% Mid-term exam or Design Project. Due: TBA
30% Special Design Problem: Due: TBA

**Tentative Syllabus:**

| Week | Lec. | Date | Topic | Lab |
|---|---|---|---|---|
| 1 | T | 1/6/15 | Course Overview, Risk Assessment | |
| | | | **Engineering Hydrology** | |
| | R | 1/8/15 | Frequency Analysis, Storm Runoff Estimation | Campbell Tract |
| 2 | T | 1/13/15 | Runoff Reality Check | |
| | | | **Hydraulic Design** | |
| | R | 1/15/15 | Fluid mechanics | Watershed Delineation & Runoff Calculation |
| 3 | T | 1/20/15 | Open Channel Hydraulics, Vegetated Waterways | |
| | R | 1/22/15 | Hydraulic structures; Pipe Spillways | South Campus Putah Creek |
| 4 | T | 1/27/15 | Drop Spillways, Chutes | |
| | R | 1/29/15 | Hydraulic Outlet Design | Lot 58 - spillway and culverts |
| 5 | T | 2/3/15 | Natural Channel Design | |
| | | | **Water Quantity Control** | |
| | R | 2/5/15 | Flood Control | Midterm |
| 6 | T | 2/10/15 | Ponds, wetlands, detention basins | |
| | R | 2/12/15 | Level Pool Flood Routing | Arboretum water way |
| 7 | T | 2/17/15 | Water Supply Reservoirs | |
| | R | 2/19/15 | Hydrological Budget | Introduction of Final project |
| | | | **Nonpoint Source Pollution** | |
| 8 | T | 2/24/15 | Pollutants, Sources, and Controls; Determining NPS pollution loads | |
| | R | 2/26/15 | Sediment Control, Wetlands and Infiltration Basins (drains) | West Arboretum slopes or Garrod Road corral |
| 9 | T | 3/3/15 | Vegtation considerations, *real* runoff and riparian buffers | |
| | R | 3/5/15 | Non-structural NPS pollution controls | Surprise field trip |
| 10 | T | 3/10/15 | | |
| | R | 3/12/15 | Final Project Due in class | |

Text Reading Schedule – Most topics will be supplemented with handouts

| | **Chin (2012)** | Tollner (2002) | Haan et al. (1994) | Schwab et al. (1993) |
|---|---|---|---|---|
| Course Overview – conservation and the Environment | Chapter 1 | | | |
| **Quantitative Hydrology** | | | | |
| Risk Assessment & Frequency Analysis (Rainfall) | 344 – 421 | 20 – 43 | 38 – 54,<br>5 – 27 | 18 – 58 |
| Storm Runoff Estimation | 422 – 433<br>473 – 509 | | 67 – 93 | 68 – 90 |
| Runoff Reality Check | | | | |
| **Hydraulic Design** | | | | |
| Fluid Mech. & Hydraulics | 9 – 46 | | 104 – 114 | |
| Open Channel Hydraulics | 166 – 182 | 205 – 237 | 122 – 140 | 265 – 286 |
| Vegetated Waterways | 182 – 199 | 138 – 156 | 115 – 122 | 134 – 152 |
| Hydraulics of Structures; Pipe Spillways | 144, 250 - 275 | 291 – 327 | 144 – 179 | 182 – 193 |
| Drop Spillways and Chutes | 282 – 312 | 297 – 303 | | 173 – 182 |
| Impact Basins and Dissipators | 312 – 318 | | | |
| Stream Restoration | | | | |
| **Water Quality Control** | | | | |
| Flood Control | 318 – 323 | | | |
| Unit Hydrograph | 495 – 509 | 329 – 369 | | 194 – 232 |
| Level Pool Flood Routing | 520 – 533 | 335 – 341 | 182 – 201 | 232 – 244 |
| Water Supply Reservoirs | | | | |
| Hydrological Budget | | | | |
| Evapotranspiration | 624 – 654 | | | |
| **Nonpoint Source Pollution** | | | | |
| Pollutants, Sources, and Controls | | 177 – 203 | | |
| Determining NPS Pollution Loads | | | | |
| Sediment Control | | 137 – 174 | 311 – 390 | 107 – 111 |
| Best Management Practices | | 178 – 204 | | |
| *Real* Runoff and Riparian Buffers | | | | |
| Wetlands | | | | |
| Non-Structural NPS Pollution Controls | | | | |

Optional Texts

Tollner, *Natural Resources Engineering*, Iowa State Press (2002)

Haan, Barfield, and Hayes, *Design Hydrology and Sedimentology for Small Catchments*. Academic Press (1994)

Schwab, Fangmeier, Elliot and Frevert, *Soil and Water Conservation Engineering 4th ed.*, John Wiley $ Sons, Inc. (1993)

**HYD-198 Grading Rubric for Assignments and Projects**

| Score | 5 | 4 | 3 | 2 | 0 |
|---|---|---|---|---|---|
| **PRESENTATION** | | | | | |
| General Appearance (counts half) | Professional | Very Neat | Adequate | Homeworky | Messy |
| Organization (& Appropriate Appendix) | Appropriate for audience; Lucid and easy to follow; Results are obvious | Good but not the best for the intended audience | Organization is not adequate for those outside of HYD145 | Difficult to follow the organization or very cluttered | No obvious organization scheme |
| Figures | Appropriate # of figures; Well labeled; Easy to find; Easy to read | Figures are adequate but lacking in number and/or readability | Figures are hard to find and difficult to decipher | Figures are sloppy (e.g. axes unlabeled) | No Figures |
| Writing (counts double) | Clear and concise; Grammar good; Active language | Adequate but somewhat wordy and/or some language errors | Readable and understandable but not polished | Errors are very distracting | Undecipherable |
| Significant Figures/Digits and ref's, units, etc. (counts half) | Perfect | Good for the most part | Adequate, but not so great in one area | Not so great in multiple areas | Needs substantial improvement |
| **CONTENT** | | | | | |
| Results | Perfect | Inaccurate results but still reasonable, probably caused by a single, simple mistake | Inaccurate and unreasonable results caused by simple mistakes | Inaccurate and unreasonable results caused by multiple or serious mistakes | I have no idea how you go such screwy results |
| Approach | Perfect and/or very creative | Followed course instructions but made a few minor mistakes | Followed course instructions but made major mistakes | I can't completely understand what you did | I am completely confused |
| Calculations and Analysis | Appropriate for intended purpose | Some equations were either inappropriate or a few calculations were wrong | Substantial analytical problems | Serious mechanical problems with analyses | Graders debate whether or not you have been in class at all |
| Choice or determination of Parameters | Appropriate justification provided where ever necessary | Parameters are sketchy or not clearly justified in some areas | Often unclear how parameters were determined | Parameter choices and/or justification is consistently unclear | Parameters magically appear |
| Discussion | Good thoughts concerning results; Addressed all questions & more | Addressed all posed questions but some inadequately | Did not address all questions | Inadequately addressed some questions | No thoughts |