

1. **ES/CE/GEOL 452: Geohydrology (Online Lecture and Laboratory)**
2. **Credits & Contact Hours:** 4 credit hours (every fall – lecture and laboratory);  
Online class: Canvas and Zoom from 3:30pm to 5:00pm on Monday/Wednesday/Friday; office hours by appointment. You can contact me through NMSU email and/or Canvas Messaging.
3. **Instructor's name:** Dr. Kenneth C. Carroll  
Office: Skeen Hall, Rm. N336  
Office phone number: 575-646-5929  
Email: kccarr@nmsu.edu
4. **Textbook:**  
**Required:** *Applied Hydrogeology* / Edition 4 By C.W. Fetter. 2000; Prentice Hall; ISBN-13: 9780130882394 and ISBN: 0130882399  
**Recommended:** *Hydrogeology Laboratory Manual*, Second Edition. 2003, By Keenan Lee, C.W. Fetter, and John E. McCray, Pearson Education.  
Other supplemental materials: Aquifer testing and groundwater modeling software and other readings supplied by the instructor.
5. **Course Information**
  - a. **Course Description:** Origin, occurrence, and movement of fluids in porous media and assessment of aquifer characteristics. This course will also develop a thorough understanding of groundwater hydrogeology through the lecture and laboratory, which will include experimental methods as well as analytical and numerical models. The focus will be on the application of hydrogeology for water resources. It will cover groundwater resource assessment, impact analysis, aquifer test analysis, monitoring/characterization, dewatering, aquifer storage and recovery, and resource management. Additionally, case studies will illustrate the use of groundwater flow models for various hydrogeologic applications, and the course will cover the most widely used modeling software packages. Cross-listed with ES, CE, and GEOL, which illustrates the interdisciplinary nature and applicability of the course content.
  - b. **Prerequisites:** No specific courses required, but must be upper level undergraduate or graduate student. Required math for ES and CE (algebra and calculus) will be used in lectures and assignments. A differential equations course is not required, and we will not be solving any differential equations. I am happy to help with any algebra and calculus questions, and we will go over problems in class to teach students how to solve them.
  - c. **Class Format:** Geohydrology (this year) is entirely online, internet-based course. This class is typically not online, but I am making it online due to the current COVID-19 pandemic to decrease transmission risks. This course is organized by modules in Canvas. You will complete a module each week of the course. You can access the modules tab on the left-hand side of your Home page. We will have a web-based class at the regularly scheduled time, and this time will be used for labs, questions, and discussions. The lectures will be recorded, and I will post them as videos and pdf files. All assignments and assessments will be setup through Canvas. You must have access to an Internet connection and Canvas, NMSU's online course management system. You can find more information on Canvas and find computer requirements for using Canvas as a student by accessing this site: <http://studenttech.nmsu.edu/learnnmsuedu.html>. I will send weekly communication to all

students using the Announcements tool in Canvas. I will also use Announcements to send important messages that pertain to everyone.

- d. General Policies:** Students are expected to have access to the text book, a scientific standalone calculator, a pencil, and notepad. Due dates are clearly stated for each assignment. Note: this is not a self-paced course. There are set due dates for each assignment. Laboratory reports are due one week after the laboratory experiment is performed unless another due date is specified. It is a requirement in this class that you set your New Announcements in Notifications to “Right Away” to ensure that you receive any announcements. To do this: go to Profile>Notifications, find for new announcements and set to Right Away.

## 6. Course Goals

- a. Outcomes of instruction:** The primary objective of this course is for students to become familiar groundwater hydrology issues, problems, and analysis methods. Another objective is for students to learn critical thinking, problem solving, and reporting skills. The students will learn to apply theories through modeling assignments in the laboratory section. At the conclusion of the course the student will be able to: Use hydrologic principles to assess origins and movement of water in aquifer systems. Perform routine analyses of geohydrologic data to characterize and model movement of water in the subsurface, and assess impacts of groundwater management on aquifer status. Assess movement of water in aquifer systems, develop a water balance, measure groundwater flow and storage properties, evaluate water quality and contaminant movement, evaluate aquifer test results, and develop conceptual and quantitative models of groundwater systems.
- b. Student Outcomes:**
- An ability to apply knowledge of mathematics, science, and engineering
  - An ability to design and conduct experiments, as well as to analyze and interpret data
  - An understanding of professional and ethical responsibility
  - An ability to communicate effectively
  - The broad education necessary to understand the impact of science and engineering solutions in a global, economic, environmental, and societal context
  - A recognition of the need for, and an ability to engage in life-long learning
  - A knowledge of contemporary water resources issues
  - An ability to use the techniques, skills, and modern hydrogeologic tools necessary for science and engineering practice.

## 7. Tentative Topics Covered

- **Lecture Topics:**
  - Hydrologic Cycle/Budget
  - Evaporation and Precipitation
  - Runoff and Streamflow
  - Properties of Aquifers
  - Principles of Groundwater Flow
  - Soil Moisture and Groundwater Recharge
  - Aquifer Testing Methods and Analysis
  - Regional Groundwater Flow
  - Groundwater in Various Geologic Environments
  - Water Chemistry and Solute Behavior in Groundwater
  - Groundwater Contamination and Restoration
  - Groundwater Development
  - Field and Modeling Methods
- **Laboratory Topics:**

- Water Budget: Precipitation and Evaporation
- Water Budget: Runoff, Storage, and Groundwater Flow
- Regional Aquifer: Colorado
- Water Chemistry and Water Quality
- Porosity, Specific Yield, and Specific Retention
- Darcy's Law and Hydraulic Conductivity
- Modeling Groundwater with Flownets and MODFLOW
- Aquifer Testing: Analysis Methods
- Aquifer Testing: Nonideal Aquifers

## 8. Grading

- Homeworks 15%
- Lab Reports 15%
- Participation/Quizzes/Teaching Presentations 15%
- Midterm Exam 1 15%
- Midterm Exam 2 15%
- Final Exam 25%
- The percent to letter grade correspondence will be as follows: A: 90-100; B: 80-89; C: 70-79; D: 60-69; F: Below 60. The letter grade cutoff may be lowered at the instructor's discretion.

**The final exam covers the entire course.**

**Any assignments turned in late or not turned in will be graded at 0%, but partial credit will be given on assignments submitted on time.**

## 9. Additional Information

### Computer Hardware & Software:

- Access to a **Windows or PC** desktop computer or laptop with internet access, sound, and speakers. Contact me if you are considering using a Chrome Book, which is not preferred.
- Canvas Learning Management System
  - [NMSU Canvas login](#)
  - [Canvas student FAQ](#)
- [Microsoft Office 2007 or higher](#)
- [Adobe Reader](#) (for reading PDF files)
- Adobe Connect – built into Canvas. No download needed.
- Headset with microphone.

## Web Browsers

Use only the latest version of Google Chrome or Mozilla Firefox for Canvas. Safari, Internet Explorer, and Microsoft Edge have known issues that can interfere with performing basic tasks within Canvas. The links to download the recommended browsers as well as instructions on how to ensure you have the latest version are listed below:

- [Download Google Chrome](#)
- [How to update Google Chrome](#)
- [Download Mozilla Firefox](#)
- [How to update Mozilla Firefox](#)

Canvas does not fully support mobile devices; while there is a free Canvas mobile app available through iTunes store, a lot of functionality is unavailable when using a mobile phone. When you take this course, it is assumed you have access to a computer or laptop for full access to functionality in this course.

## Required Technical Skills:

Taking an online course requires technical skills as well as other soft skills. However, at a minimum you will need to meet certain technology responsibilities to complete work for this course. If you have questions about technical requirements for the course, please contact me immediately.

To begin in this course, you must:

- Be able to obtain access to an internet connection, preferably broadband, and a working computer for the duration of this course.
- Be proficient with Microsoft© Office applications. Be able to install software on your computer (I might be able to assist by discussing how to if you setup an appointment).
- Be able to conduct research searches on the Internet; see the NMSU LibGuides and Cornell's Guide to Online Research
- Be able to send and receive emails and email attachments in and out of class.
- Be able to change your Canvas Notification settings.
- Be able to maintain backups of all work you create for this course.

## Netiquette:

Online course expectations for netiquette are:

- Don't flame (personally attack) someone. It is possible to disagree with an idea without flaming the person espousing the idea.
- Use emoticons and acronyms to convey your emotional intent in order to avoid misunderstandings.
- Remember that the concept of "politeness" is defined for us by the families and cultures of which we are a part. What is considered polite communication in one family or culture may be impolite in another. Sometimes you may inadvertently seem impolite or feel that someone else was being impolite. Talk it out instead of assuming the person meant to be rude.
- Listen actively.
- Think critically. Critical thinking, grounded in intellectual integrity, is expected. In other words, seek clarity of meaning and understanding.
- Question ideas, not people.
- Attempt to see things from other perspectives.

- Use supporting relevant information.

**Academic Integrity:** It is expected that students will maintain the highest degree of academic integrity and honesty. Students are expected to complete their own work to the best of their ability, and you are required to be familiar with university policies and procedures in the current NMSU Undergraduate Catalog. Policies and procedures for dealing with such cases are detailed in the Student Handbook <http://www.nmsu.edu/~vpsa/SCOC/index.html>. An explanation of plagiarism can be found here: <http://lib.nmsu.edu/plagiarism/>. Please see the Student Code of Conduct in The Student Handbook: <http://deanofstudents.nmsu.edu/student-handbook/1-student-code-of-conduct/> and pay particular attention to “III.B. Academic Misconduct.” Academic misconduct will not be tolerated and will result in severe penalties including an F in the class.

### **Student Accessibility Services**

If you have, or believe you have, a disability and would benefit from accommodations, you may wish to self-identify. Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act Amendments Act (ADAAA) covers issues relating to disability and accommodations. If a student has questions or needs an accommodation in the classroom (all medical information is treated confidentially), contact:

Trudy Luken, Director Student Accessibility Services (SAS) - Corbett Center, Rm. 244

Phone: (575) 646-6840 E-mail: [sas@nmsu.edu](mailto:sas@nmsu.edu)

Website: <http://sas.nmsu.edu/>

NMSU policy prohibits discrimination on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex, sexual orientation, spousal affiliation and protected veterans status. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct: sexual violence (sexual assault, rape), sexual harassment and retaliation.

For more information on discrimination issues, Title IX, Campus SaVE Act, NMSU Policy Chapter 3.25, NMSU's complaint process, or to file a complaint contact: Gerard Nevarez, Title IX Coordinator  
Agustin Diaz, Title IX Deputy Coordinator

Office of Institutional Equity (OIE)-O'Loughlin House, 1130 University Avenue

Phone: (575) 646-3635 E-mail: [equity@nmsu.edu](mailto:equity@nmsu.edu)

Website: <http://eeo.nmsu.edu/>

Other NMSU Resources:

NMSU Police Department: (575) 646-3311 [www.nmsupolice.com](http://www.nmsupolice.com)

NMSU Police Victim Services: (575) 646-3424

NMSU Counseling Center: (575) 646-2731

NMSU Dean of Students: (575) 646-1722

For Any On-campus Emergencies: 911

If you are already registered with the SSD office and need accommodations please provide your “Accommodation Memo” from the SSD within the first two weeks of class.

### **Non-Discrimination Policy**

NMSU policy prohibits discrimination on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex, sexual orientation, spousal affiliation and protected veterans status. Furthermore, Title IX prohibits sex

discrimination to include sexual misconduct, sexual violence, sexual harassment and retaliation. For more information on discrimination issues, Title IX or NMSU's complaint process contact: Office of Institutional Equity (OIE) - O'Loughlin House  
Phone: 646.3635 E-mail: [equity@nmsu.edu](mailto:equity@nmsu.edu)  
Website: <http://www.nmsu.edu/~eeo/>

### **Academic Resources**

NMSU provides students with academic resources such as tutoring, final exam schedules, library and research, and transcript information on the [NMSU Current Student](#) webpage.

### **Student Support Services**

Find information and support on advising, registration, and financial aid on [NMSU Current Student](#) webpage. You will also find links to the academic calendar, Student Affairs, the student handbook, and Student technologies on this page.

### **Technical Support**

The ICT Customer Service Center is equipped to deal with all of your information technology (IT) and telecommunications needs at NMSU. Please feel free to contact them at (575) 646-1840 or via email at [helpdesk@nmsu.edu](mailto:helpdesk@nmsu.edu). You can also go to the Student Technology Help [Student Technology Help](#) web page and [Student Resources](#) located at the Canvas web page for additional information on Canvas.

### **Campus Activities**

Campus Activities offers activities outside the classroom involvement. The program/services are non-academic and are provided directly to the student. A complete list of offered activities can be found on the [Campus Activity](#) website.

You can also go to the [Student Technology Help](#) web page and Student Resources located at the [Canvas](#) web page for additional information on Canvas.>

### **Accessibility of eLearning Tools**

This course uses several software programs and technologies. Please read the following for more information about their accessibility.

**Note:** A Voluntary Product Accessibility Template (VPAT) is a standardized form developed by the Information Technology Industry Council to show how a software product meets key regulations of Section 508 of the Rehabilitation Act.

- [Canvas Accessibility](#) Standards and help.
  - Canvas-compatible Screen Readers: [Voiceover](#) (Mac), [JAWS](#) (PC)
- [Adobe Products Accessibility](#) for Adobe Connect 9, Adobe Acrobat, and more.
- [Apple Products VPATs](#) and [Accessibility features](#) for Safari Web Browser, Mac OS X, and more.
- [Microsoft Products: Section 508](#) and [Microsoft Accessibility](#) for Office, Skype, and more.
- [Google VPATs](#) and [Accessibility Products and Features](#) for Google Earth, Chrome Web Browser, Google Docs, and more.
- [Firefox Web Browser: Section 508](#) (version 3.5 and up)

### **Privacy Policies**

We take protecting and honoring your privacy very seriously at NMSU. Please note that several software and technology materials are used in the course. Their privacy policies are noted below.

- [Canvas Privacy Policy](#)
- [Adobe Privacy Policy](#)

- [FireFox Privacy Policy](#)
- [Google Product Privacy Guide](#) (e.g., Chrome, Google Drive, YouTube)
- [Microsoft Privacy Policy](#)
- [Apple Privacy Policy for software and devices](#)

### **Honors Course Policy**

Students who wish to have this course count as an Honors course may do so by completing the Course by Contract form: <https://honors.nmsu.edu/for-students/honors-courses-by-contract/>. I will assign you additional work that will permit you to gain Honors credits for this course in your major. These credits will count as upper division credits towards the accumulation of 18 credits needed to graduate with University Honors. For additional information on pursuing the Honors recognition at graduation, contact the Honors College at 575-646-2005 or email Dean Chaiken at [mchaiken@nmsu.edu](mailto:mchaiken@nmsu.edu). Completed Contract forms must be submitted in person to the Honors College no later than 1 week after the beginning of each semester.

### **Disclaimer**

The instructors reserve the right to modify the course schedule or other aspects of the syllabus during the semester as considered necessary to achieve course objectives. Any necessary changes to the syllabus (or to the course schedule) will be announced in class and you are responsible for being aware of them.