

**Course Description and Syllabus**  
**GEOL 4/52074 Environmental Core and Well Logging**  
**Kent State University Department of Geology**  
**Spring 2017**

**Instructor:** Dr. Joseph D. Ortiz  
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**Lecture:** MW: 9:15am-10:30am, Room 234 McGilvrey Hall  
**Office Hours:** MWR 10:30am-12:30pm; T 10:00-11:00am; R 2:00-3:00pm or by appointment.

**SGE Room Geology tutoring (Starting 3<sup>rd</sup> week of the term):** TWR 11:00 am - 2:00 pm, Room 223 MCG, No appointment necessary.

**Course Catalog Number:** 42074, Section 1 for undergraduate; 52074, Section 1 for graduate students  
**Registrar's Call Number:** 14106 for undergraduates; 14116 for graduate students

**Course Rationale and Objectives:** Many basic and applied questions in the Earth Sciences require detailed knowledge of the sub-surface properties and spatial distribution of stratigraphic layers. Core and well logging methods are extremely useful in the fields of paleoclimate, hydrogeology, engineering geology, oil and gas exploration, and environmental remediation. Students in this class will learn the theory behind a range of methods. They will gain hands on experience using magnetic susceptibility and reflectance methods to address real-world logging problems. Examples from a variety of fields will be presented.

**Online Information:** The class website can be accessed via Blackboard Learn. To check your grades using your university email login name and password, login to flashline (<http://flashline.kent.edu>) and go to "My Courses", and select the link for Blackboard Learn.

**Required Texts and other reading material:**

For Graduate students:

Ellis, Darwin V., Singer, Julian M. "Well Logging for Earth Scientists" 2nd ed., 2007, XIX, 692 p. 450 illus., Hardcover ISBN: 978-1-4020-3738-2.

(NOTE: This book is available to KSU students at no charge online through OhioLink).

For Undergraduate **and** Graduate

Rider, M. H., and Kennedy, M., The Geological Interpretation of Well Logs, 3rd edition, published by Rider-French Consulting Ltd. 432p., 2011, ISBN: 978-0-9541906-8-2.

(NOTE: This book is **not available at the KSU Bookstore**. It must be purchased directly from the publisher, Rider-French Consulting LTD online at their website: <http://www.riderfrench.co.uk/index.html?home.html>)

Depending on the pace of the class, additional reading may be assigned from the following sources and/or the open literature, and handouts:

Blum, P., 1997, Physical properties handbook: a guide to the shipboard measurement of physical properties of deep-sea cores. ODP Tech. Note, 26 [Online]. Available from World Wide Web: <<http://www-odp.tamu.edu/publications/tnotes/tn26/INDEX.HTM>>. [Cited 2004-08-13].

**Online Material:** <http://www-odp.tamu.edu/publications/tnotes/tn26/INDEX.HTM>

International Ocean Discovery Program JOIDES Resolution Science Operator Website: Technology pages, Texas A&M University

**Online Material:** <http://iodp.tamu.edu/tools/logging/index.html>

**Office Hours and Consultation with the Instructor:** I want you to do well in this course! I welcome questions from all students either in person, by email, or by phone. Whether you are doing well in the course, find it challenging, or are on academic probation, attending office hours can help make the course a more enriching experience. Following university policy and to ensure your own privacy when sending electronic messages, please use your university email account for all correspondence related to this class. Include your first and last name on any electronic correspondence. Please cc a copy of any important messages that you send to the instructor back to yourself so that you have a record.

**Grading Policy:** Students are expected to attend class, do the reading, and consult the web site throughout the term and participate in class discussions. These steps will help you to learn the material covered on the exams. There will also be in-class activities assigned during the term. They will allow you to gauge your progress and provide you with credit for class participation. Grades will be based on the assigned work as follows:

Undergraduates enrolled in the 40000-level section		Graduate Students enrolled in the 50000-level section	
Mid-term Exams (three worth 15% each)	45%	Mid-term Exams (two worth 15% each)	45%
Cumulative Final Exam	30%	Cumulative Final Exam	30%
Class Projects/Class Participation	25%	Class Projects/Class Participation	10%
		Term Project	15%
<b>Total</b>	<b>100%</b>	<b>Total</b>	<b>100%</b>

**Class Projects:** Projects for the class will consist of readings and research projects. Students are encouraged to discuss the readings with others students in the class outside of the class meetings prior to the class session during which we will discuss the assigned reading. All students are required to participate in class projects and class discussions by asking and answering questions. The groups assigned in class should complete any research projects that are turned in for a grade.

**Graduate Term Project:** For graduate students enrolled in the 50000-level section, this course will require significant amounts of independent scholarship. Student will be expected to research a particular topic of interest on the syllabus, generate a bibliography of publications from the literature and complete a 10-page term paper on the subject including references and figures. The purpose of the paper is to synthesize a specific topic and provide an insightful discussion, rather than a broad survey of the literature. If possible, graduate students are encouraged to select a research topic that results to their thesis or dissertation work in some fashion. Students will be guided through this process during the term as they complete various stages of the project: (1) Bibliography of sources, (2) description of research question, (3) outline, (4) initial draft, (5) Final draft.

Information to assist you with writing a research paper can be found on the Earth Science Writing Guide at the Kent State University Library website: <http://libguides.library.kent.edu/content.php?pid=330893&sid=2706580>

**Exams:** The exam questions may involve the interpretation of maps, diagrams, and graphs. The midterm exams

will give students an opportunity to demonstrate their knowledge of the material presented. While the mid-term exams will be non-cumulative, the final exam will be cumulative. Exam scores may be curved at the discretion of the instructor, but each student has the potential to succeed in this course. Students are expected to pick up their graded exam papers in class when they are returned, or to make arrangements to do so at office hours.

**Make-up Exams:** Students are expected to manage their academic and personal activities responsibly during the term. Students who miss an exam must provide a written documentation in a timely manner in order to receive a make-up exam. Legitimate excuses for missing an exam include written documentation for the following: conflict with another Kent State University academic activity (such as an on or off campus field trip), your own illness, a death in the family, and military or intercollegiate athletic commitments. If you are involved in military or official university athletic activities, review the exam schedule at the beginning of the term and consult with the instructor prior to the exam if you have a conflict. If you have an illness, personal crisis or family tragedy that results in missing an exam, you must contact the instructor by phone or email no later than 48 hours after the scheduled start time of the exam. It is very important that you provide your name and a telephone number where you can be reached in your phone or email message.

**University Policies: The following University policies apply to anyone enrolled in this course:**

**1. Enrollment Status:** The official registration deadline for this course is **01/22/2016**. Courses can have different scheduling deadlines depending on their mode of instruction. University policy requires all students to be officially registered in each class they are attending. Students who are not officially registered for a course by the published deadline should not be attending class and will not receive credit or a grade for that course. Each student must confirm enrollment by checking his/her class schedule (using Student Tools in FlashFast) prior to the deadline indicated. Registration errors must be corrected prior to the deadline. You can look up your course using the Kent State University Self Service Scheduling tool. Enter the information needed to find the course for which you are searching. The withdrawal dates can be found from the link in the final column.

**2. Academic Honor Code:** All students in the course are expected to abide by the academic honor code, as specified in the University's Policy Register. The use of other's intellectual property without giving them appropriate credit is a serious academic offense. This includes copying answers, misrepresenting the source, nature or other conditions of your academic work to get undeserved credit. At a minimum, students caught cheating on an exam will receive a midterm grade of zero, which will count toward their class average and the incident will be reported to the university for further potential action. It is the University's policy that cheating or plagiarism can result in receiving a failing grade for the course or other more serious disciplinary action depending on the nature of the offense. Repeat offenses can result in dismissal from the University. For complete information see Ch. 3-01.8 of the University Policy Register.

**3. Withdrawal:** The last date to drop this class before a grade of W is assigned is **01/22/2017**. The last day to withdraw from this class or any class with a grade of W assigned is **01/29/2017**. No approval is required to withdraw from a course prior to the withdrawal deadline. Student who stop attending the course, but who do not drop or withdraw from it will receive a grade of "SF". Student who enroll in the class, then never attend and who do not drop or withdraw from it will receive a grade of "NF". Students should be aware that receiving a grade of "SF" and "NF" could result in a financial aid audit and a loss of financial aid. Dropping or withdrawing from a class may also affect a student's financial aid status or academic eligibility for athletics. If a student is unable to complete a class or all classes in during a semester because of extreme circumstances, which first occur after the withdrawal deadline, he or she should consult their college or campus dean's office. Any course withdrawal processed after the withdrawal date will appear on the students' academic record with a grade of "W". If you have questions about the impact that a drop or withdrawal will have on your academic record or financial aid, you should consult a university academic advisor or the financial aid office. Courses can have different scheduling deadlines depending on their

mode of instruction. For information on add/drop/withdrawal dates, you can look up your course using the Kent State University Self Service Scheduling tool. Enter the info needed to find the course for which you are searching. The add/drop/withdrawal dates can be found from the link in the final column. For more info see: <http://www.kent.edu/registrar/spring-important-dates>

**4. Students with Documented Accommodation needs:** In accordance with University policy, if you have a documented disability and require accommodations to obtain equal access to this course, please contact the instructor at the beginning of the semester or when you are given an assignment for which an accommodation is required. Students with disabilities must verify their eligibility through the Office of Student Accessibility Services (SAS; <http://www.kent.edu/sas>) located on the 1<sup>st</sup> floor of the University Library (330-672-3391). If you have any questions regarding a potential accommodation need, please contact the instructor as soon as possible.

**5. Final Exam Dates:** Please check the final exam schedule for the classes in which you are enrolled. This can be found on the web at: <http://www.kent.edu/registrar/spring-final-exam-schedule>. In the event that you have two exams scheduled at the same time, the instructor will make suitable arrangements. Students who have conflicts or more than three examinations on the same day should consult with the Dean of his or her college at the earliest possible time for assistance in making alternative arrangements.

**6. Notice of my copyright and intellectual property rights:** Any intellectual property displayed or distributed to students during this course (including but not limited to power points, notes, quizzes, examinations) by Dr. Joseph D. Ortiz remains the intellectual property of the Dr. Joseph D. Ortiz. This means that the student may not distribute, publish or provide such intellectual property to any other person or entity for any reason, commercial or otherwise, without the express written permission of the Dr. Joseph D. Ortiz.

### Spring 2017 Environmental Core and Well Logging Class Schedule and Assignments

Week	Date (MW)	Lecture Number and Title	Readings	Assignment
1	Jan 18	Introduction to coring and well logging; The Logging Environment	Ellis and Singer Chapter 1 Rider & Kennedy, Chapters 1 and 2	
2	Jan 23, 25	Sampling considerations Logging Methods overview Thermcon logging	Ellis and Singer Chapter 2 Rider & Kennedy, Chapter 4	
3	Jan 30, Feb 1	Caliper logging Electric Logging: Spontaneous Potential and Resistivity	Ellis and Singer Chapter 3, 4 Rider & Kennedy, Chapters 5, 6 and 7	<b>Exam 1: Feb 1</b>
4	Feb 6, 8	Resistivity-based logging Microresistivity Log Interpretation	Ellis and Singer Chapter 5, 6 Rider & Kennedy, Chapter 7, 12	<b>Grads Select Term project</b>
5	Feb 13, 15	Color Theory, Visible (VIS) reflectance derivative spectroscopy, Near Infrared (nIR) Theory and applications	Reflectance Spectra by R. Clark (urls or handout to be provided.) <a href="#">Color Theory</a>	
6	Feb 20, 22	Nuclear processes	Ellis and Singer Chapter 10 Rider & Kennedy, Chapter 8	<b>Exam 2: Feb 22</b>
7	Feb 27, March 1	Active Gamma Methods (Gamma Density and Photoelectric effect)	Ellis and Singer Chapter 12 Rider & Kennedy, Chapter 10	<b>Grads Term Project bibliography</b>
8	March 6, 8	Passive Gamma Methods (Total Natural Gamma and Spectral Natural Gamma)	Ellis and Singer Chapter 11 Rider & Kennedy, Chapter 8	
9	March 13, 15	Neutron Porosity Logging	Ellis and Singer Chapter 13, 14 Rider & Kennedy, Chapter 11	<b>Grads Term Project Outline</b>

<b>10</b>	March 20, 22	Sonic or Acoustic logging methods	Ellis and Singer Chapter 17 Rider & Kennedy, Chapters 9	<b>Exam 3: March 22</b>
<i>Spring Break, No Classes</i>				
<b>11</b>	April 3, 5	Newark Basin Logging Project	Materials TBA	<b>Grads Term Project First Draft</b>
<b>12</b>	April 10, 12	Magnetic logging + Newark Basin Logging Project	Blum, ODP Physical properties Handbook, Chapter 4, Nov. 1997. Sun and Liu, EPSL 180, 287-296, 2000.	
<b>13</b>	April 17, 19	XRF Elemental Core logging + Newark Basin Logging Project	Richter et al., ODP SR 175 Chapter 13. Jansen and Dupont, ODP SR 175 Chapter 20.	<b>Newark Basin Homework due: April 19</b>
<b>14</b>	April 24, 26	Multi-sensor core logging	Weber et al., Mar Geo, 136, 151-172, 1997.	
<b>15</b>	May 1, 3	MWD, LWD, and Formation evaluation	Ellis and Singer Chapter 6, 20 Rider & Kennedy, Chapters 15, 16	<b>Grads Term Project Final Version</b>
<i>End of class sessions</i>				
<b>16 Finals Week</b>	<b>May 9</b>	<b>Cumulative Final Exam McGivrey Hall Room 234  Tuesday, May 9, 10:15-12:30 pm</b>		

### Optional List of Text books about Geophysical Wireline Logging

While this list is not required reading, you may find the following resources useful while take this class or if you decide to pursue this specialty as a career:

- Asquith G. and Gibson, C., Basic Well Log Analysis for Geologists, The American Association of Petroleum Geologists, Tulsa, OK, 216 p., 1982.
- Brock, J. Analyzing your logs, Fundamentals of Open Hole Log Interpretation, Volume I , Petro-Media, Inc., 1st ed., 1984.
- Crain, E.R., The Log Analysis Handbook, Quantitative Log Analysis Methods Series, vol. 1, PennWell Publishing, Tulsa, OK, 684 p., 1986.
- Halliburton Energy Services, NMR Logging Principles and Applications, Gulf Professional Publishing, 2001, ISBN-10: 0967902606, ISBN-13: 978-0967902609, 234 pages
- Hearst, J.R., Nelson, P.H. and F.L. Paillet, Well Logging for Physical Properties: A handbook for Geophysicists, Geologists, and Engineers, 2nd Edition, John Wiley and Sons, New York, NY, 483 p., 1985.
- Johnson, D.E., and K.E. Pile, Well Logging for the Nontechnical Person, PennWell Publishing, Tulsa, OK, 198 p., 1988.
- Keys, W.S., Borehole Geophysics applied to Ground-Water Investigations, National Water Well Association, Dublin, OH, 313 p., 1989.
- Labo, J., A Practical Introduction to Borehole Geophysics: An Overview of Wireline Well Logging Principles for Geophysicists (Geophysical References, Vol. 2), Society of Exploration, 1987, ISBN-10: 0931830397, ISBN-13: 978-0931830396, 330 pages.
- Luthi, S., Geological Well Logs, Springer-Verlag New York, Inc; 1st edition, 2001, ISBN-10: 3540678409 ISBN-13: 978-3540678403, 373 pages.
- Repsold, H. Well Logging in Groundwater Development, International Contributions to Hydrogeology Series, vol. 9, Verlag Heinz Heise, Hannover, West Germany, 135 p., 1989.
- Selley , R.C., Elements of Petroleum Geology, Academic Press; 2nd ed, 1997, ISBN-10: 0126363706, ISBN-13: 978-0126363708, 470 pages.
- Serra, Well Logging Data Acquisition and Applications, Technip Editions, 2004, ISBN-10: 2951561253, ISBN-13: 978-2951561250.
- Tang X.M. and Cheng, A., Quantitative Borehole Acoustic Methods, Volume 24 (Handbook of Geophysical Exploration: Seismic Exploration), Pergamon; 1 edition, 2004, ISBN-10: 0080440517, ISBN-13: 978-0080440514, 274 pages.