GEOG 372 – Fall 2014

**Introduction to Remote‐Sensing**

(3 Credits)

**Lectures:** Monday and Wednesday 9:00am - 9:50am

Room: LeFrak Hall 1124

See lecture scheduler and topics below

**Laboratory classes:** Section 0101: Wednesday 11:00am - 1:00pm

Section 0102: Wednesday 1:00pm - 3:00pm

Room: LeFrak Hall 1138

Assigned times cannot be changed owing to limited space in the lab.

The lab may also be used during open hours as needed. Check

the lab scheduler here: <http://geog.umd.edu/content/lab-conduct-policy>

**First class:** Wednesday, September 3

**Last class:** Wednesday, December 10

**Instructor:** Dr. Peter Potapov

[potapov@umd.edu](mailto:potapov@umd.edu)

Office Hours: Room 1135 LeFrak Hall, Wed 11:00am‐3:00pm

Strictly by appointment

**Teaching Assistant:** Zan M. Dodson

[zdodson@umd.edu](mailto:zdodson@umd.edu)

Lab Hours: Room 1138 LeFrak Hall, Wed 11:00am‐3:00pm

Additional Office Hours: Room 1113 LeFrak Hall, Wed 10:00am – 10:50am

Otherwise by appointment only

**Course on‐line materials.** The ELMS course site is at https://elms.umd.edu where all announcements, lectures, class materials, exams and grades will be posted.

**Student Learning Outcomes:**

This course is intended to provide an introduction to remote‐sensing of the environment, emphasizing the techniques that are used to monitor the Earth’s land surfaces. It will include the interaction of electromagnetic radiation with the land surface, passive optical and thermal wavebands with brief outlines of LiDAR and RADAR. Particular attention will be given to satellite‐borne sensors and digital data processing. The main theme will be how quantitative information from remotely sensed data of spatial and environmental relationships are acquired, processed and used. All topics will be related to examples of remote sensing applications. The lab sessions will provide hands‐on analysis of remotely‐sensed digital data using professional image processing software.

**Target Audience:**

This course is intended either as an overview for a general academic program or as a preparation for further remote‐sensing technology courses. It is a gateway for majoring in Geography and to 400 level classes in Geography. See Geography advisers in LeFrak Rm. 2108 (Tel. 301‐405‐4073) for further information on your academic program and course selection. Non‐Geography students or undeclared majors are welcome.

**Overlaps:** This course has no overlaps with other classes in the Department of Geography.

**Prerequisites:** This course does not have any pre‐requisites, but GEOG 201 and 306 are highly recommended.

**Course Structure:**

This class will consist of 24 x 50 min lecture/discussions and 9 x 2hr labs. The course is divided into 5 Topics. Following lectures on each topic there will be a 50 min test. Test topics will only include material studied in the preceding lectures. See Course schedule information on the Home page.

**Text Book:**

Campbell, J.B. and Wynne, R. H. 2011. Introduction to Remote Sensing. Guildford Press, New

York. 5th Edition. ISBN 978‐1‐60918‐176‐5

**Schedule of classes:**

See provisional schedule at the bottom of this document.

**Course organization.**

The bulk of the material in this course will be learned individually using the Study Guides. This course consists of five Topics, each covering important aspects of remote sensing. The course consists of the following components:

* **24 lectures/discussions, on each of 5 Topics.** The lectures have 2 purposes: (i) to provide a framework for your study of each Topic, and (ii) to present any particularly difficult concepts.
* **Study materials** will be provided at the start of each Topic. These will consist of sections of the textbook to study, additional texts and materials authored by the Instructor.
* **A test following each Topic**. Tests will be taken at the end of a Topic. They are multiple choice exams with factual and conceptual questions, some involve calculations. Test attendance is mandatory.
* **9 Labs plus Introductory class.** 2 hour lab sessions with written guides and supervision by a Teaching Assistant. Each lab requires a written Report which is graded.

**Assessment & Grading:**

* 5 tests: each test is 11% of the total grade (55% total)
* 9 lab exercise reports ‐ each 5% of total grade (45% total). Lab reports must be sent as PDF files to the TA by the start of the lab in the week following the class.

**Attendance**

* **Lecture/discussions:** Following Campus policy, attendance at lectures is not mandatory BUT important information (in some cases including up‐coming exam questions) will be presented.
* **Labs:** The lab classes are an essential part of this course, so attendance at all classes is mandatory, and absences or late lab reports will lead to a zero grade for that exercise. Absences are, however, excused according to the Senate policy statement given in Official Notices (below).
* **Exam make‐up** policy. Make‐up will only be given for absences according to Campus policies.

**Keys to Success:** This course is challenging for many students because of the quantitative

nature of remote‐sensing and the computer processing using complex software. While

extensive explanations will be given, always ask if anything is not clear.

The following will contribute to your success in this class:

* **Attend all lectures** – each one aims to help you learn important component of the class. Unlike some courses, in this one, each Topic builds on earlier ones and so any significant gaps in your understanding will accumulate and may leave you unable to catch up. Attending lectures is also necessary to take the in‐class tests which are 60% of the final grade.
* **Use the Study Guides** and other materials. This course is not primarily a lecture‐style class, rather you teach yourself, and the lectures are the opportunity to interact with the Instructor, ask questions, be shown how to solve numerical examples and to get the big‐picture.
* During lectures, **take notes** and after the lecture go over these to clarify any parts on which you are unsure or that you were unable to write down during the lecture. It is a good idea to cross‐reference the lecture notes with the pages in the textbook that are relevant. The lecture contents are not adequate to succeed in this course.
* You could **form a study group** with several of your classmates or utilize the ELMS online discussion board to assist with problems.
* **Ask questions**. Use Office Hours and email the Instructor or TA with questions.

**Enrollment limit:** 50 Students. There is usually a long waiting list for this class and so, to avoid

depriving others, only committed students, fully intending to complete the course should enroll.

**Geography Major Program Information:**

This course counts as a gateway course for Geography majors (see Target Audience above)

**Official Notices:**

* Attendance: *You are strongly advised to attend all lectures since this will provide a basic understanding of the subject matter of the course. The course grade is dependent upon successful completion of 5 Quizzes and 9 Lab Reports. The Campus Senate policy http://www.umd.edu/catalog/0405/chapter4.pdf) requires students who are absent due to illness/injury to furnish documentary support to the instructor (see below). In this class the policy applies to the lab classes only. You are required to contact the Instructor by email, where possible, prior to lab sessions for which they are unable to attend owing to an illness or an injury. No later than on return to class, you must provide written and, where appropriate (determined by the Instructor) signed documentation verifying that your illness/injury is such that you cannot attend the Lab session. You will not be allowed to turn in missed assignments or make up quizzes and lab classes if you have not provided this documentation. If you do not present documentation of illness or emergency, zero points will be given. In addition, if it is found that you have falsified the documentation provided, you will be referred to the University’s Student Conduct Office.*
* *Religious Observance: By the 2nd week of the course, students must provide the Instructor, in writing, any request for absence from lab classes due to a named religious observance on a specified date. Please refer to the Online Undergraduate Catalog Policy on Religious Observance.*
* *Disabilities: If you have a documented disability and wish to discuss academic accommodations, please contact the Instructor as early as possible. Every effort will be made to accommodate students who are registered with the Disability Support Services (DSS) Office and who provide me with a University of Maryland DSS Accommodation form which has been updated for the 2012 Spring semester. This form must be presented to me no later than the 2nd week of the course. I am not able to accommodate students who are not registered with DSS or who do not provide me with documentation which has been reviewed by DSS.*
* *CourseEvalUM. Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to Faculty tenure and promotion procedures. The date from which CourseEvalUM is open for you to complete your evaluations will be announced by the University. Please go directly to the website (www.courseevalum.umd.edu) to complete your evaluations by the published date*

***From the University Registration, Academic Requirements, and Regulations, Sect***

***Attendance (http://www.umd.edu/catalog/0405/chapter4.pdf.)***

* *The university expects each student to take full responsibility for his or her academic work and academic progress. The student, to progress satisfactorily, must meet all of the requirements of each course for which he or she is registered. Students are expected to attend classes regularly, for consistent attendance offers the most effective opportunity open to all students to gain command of the concepts and materials of their courses of study. Except as provided below, absences will not be used in the computation of grades, and the recording of student absences will not be required of the faculty.*
* *It is the policy of the university to excuse the absences of students that result from the following causes: illness of the student, or illness of a dependent as defined by Board of Regents policy on family and medical leave; religious observance (where the nature of the observance prevents the student from being present during the class period); participation in university activities at the request of university authorities; and compelling circumstance beyond the student’s control. Students claiming excused absence must apply in writing and furnish documentary support for their assertion that absence resulted from one of these causes.*
* *In some courses, attendance and in‐class participation are ongoing requirements and an integral part of the work of the course. In other courses, occasional in‐class assessments may occur, sometimes without advance notice. It is the responsibility of the instructor to inform each class at the beginning of the semester of the nature of in‐class participation expected and the effect of absences on the evaluation of the student’s work in the course.*
* *Absences in courses where in‐class participation is a significant part of the work of the course shall be handled by the instructor in the course in accordance with the general policy of his or her* academic *unit”.*
* *Policy on phones: Outgoing calls are not permitted during lectures. Phones must be set to silent mode. More than one occurrence of phones making an audible sound will result in the owner being asked to leave the lecture room.*
* *Policy on computers and smart phones: Students may use computers to take notes, but other uses are not permitted. Class materials on the Web should be downloaded before the class. Anyone found using their computer for purposes other than note‐taking will be asked to leave.*
* *Academic Integrity Expectations: The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit: http://www.studenthonorcouncil.umd.edu/whatis.html By registering for this course you indicate your acceptance of these provisions for academic integrity.*
* *Students are expected to treat each other with respect. Disruptive behavior of any kind will not be tolerated. Students who are unable to show civility with one another, or instructor will be subject to being referred to the Office of Student Conduct or to Campus Police. You are expected to adhere to the Code of Student Conduct.*
* *The lectures delivered in this class and the course materials are protected by federal copyright law as the Instructor’s original works. You are permitted to use course materials for your use. You may not record, reproduce, or distribute my lectures/notes for any commercial purpose without written consent. Persons who sell or distribute copies or modified copies of course materials, possess commercial copies of notes (i.e., Terpnotes), or assist another person or entity in selling or distributing those materials may be considered in violation of the University Code of Student Conduct, part 9(k).*

**Provisional schedule of course**

**Lectures**

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| --- | --- | --- | --- |
| 3-Sep | Wed | Introduction | Syllabus, Schedule and Course Aims |
| **Topic 1 - Fundamentals of Remote Sensing** | | | |
| 8-Sep | Mon | Lecture 1-1 | What is Remote Sensing? |
| 10-Sep | Wed | Lecture 1-2 | Electromagnetic Radiation |
| 15-Sep | Mon | Lecture 1-3 | Remote Sensing Instruments |
| 17-Sep | Wed | Lecture 1-4 | The Landsat Program |
| 22-Sep | Mon | Lecture 1-5 | The Development of Remote Sensing Capabilities |
| **Topic 2 – Electromagnetic Radiation** | | | |
| 29-Sep | Mon | Lecture 2-1 | EM radiation |
| 1-Oct | Wed | Lecture 2-2 | EMR interactions with the Earth’s surface |
| 6-Oct | Mon | Lecture 2-3 | EMR interactions with the Earth’s atmosphere |
| 8-Oct | Wed | Lecture 2-4 | Thermal RS |
| **Topic 3 - Analysis of Remotely Sensed Data** | | | |
| 15-Oct | Wed | Lecture 3-1 | Digital RS data |
| 20-Oct | Mon | Lecture 3-2 | Visual interpretation |
| 22-Oct | Wed | Lecture 3-3 | Digital Image Processing |
| 27-Oct | Mon | Lecture 3-4 | Vegetation Indices. Geometric Registration |
| 29-Oct | Wed | Lecture 3-5 | Classification and Accuracy Assessment |
| 3-Nov | Mon | Lecture 3-6 | Global Image Processing |
| **Topic 4 – Remote Sensing of Land-cover** | | | |
| 10-Nov | Mon | Lecture 4-1 | Land-cover and Change Mapping |
| 12-Nov | Wed | Lecture 4-2 | Qualitative Measurements of Vegetation |
| 17-Nov | Mon | Lecture 4-3 | Vegetation Phenology and Stress |
| 19-Nov | Wed | Lecture 4-4 | Remote Sensing of Global Land-cover |

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| **Topic 5 - Remote Sensing Instruments and Applications** | | | |
| 26-Nov | Wed | Lecture 5-1 | RS data providers |
| 1-Dec | Mon | Lecture 5-2 | Scanner and platform properties |
| 3-Dec | Wed | Lecture 5-3 | RADAR and LiDAR sensors |
| 8-Dec | Mon | Lecture 5-4 | Passive satellite sensors |

**Tests**

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| 24-Sep | Wed | Test #1 |
| 13-Oct | Mon | Test #2 |
| 5-Nov | Wed | Test #3 |
| 24-Nov | Mon | Test #4 |
| 10-Dec | Wed | Test #5 |

**Labs**

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| --- | --- | --- | --- | --- |
| **Date** | | **Title** | | **Due date** |
| 1-Oct | Wed | Lab 1 | Intro to Image Processing | 8-Oct |
| 8-Oct | Wed | Lab 2 | Feature Identification Using Visual Interpretation and Spectral Signatures | 15-Oct |
| 15-Oct | Wed | Lab 3 | Spatial, Spectral, and Temporal Resolution: Comparison of RapidEye, Landsat, and MODIS data | 22-Oct |
| 22-Oct | Wed | Lab 4 | Contrast Stretching and DN to Reflectance Conversion | 29-Oct |
| 29-Oct | Wed | Lab 5 | Geometric Registration and Mosaicking | 5-Nov |
| 5-Nov | Wed | Lab 6 | Vegetation Indices | 12-Nov |
| 12-Nov | Wed | Lab 7 | Image Classification & Change Detection | 19-Nov |
| 19-Nov | Wed | Lab 8 | Analyzing Thermal IR Signatures | 26-Nov |
| 3-Dec | Wed | Lab 9 | Remote Sensing Data Download | 10-Dec |