SC 220

GIS and Remote Sensing

3 Credits

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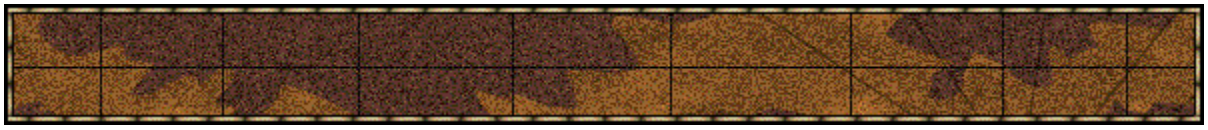

GIS and Remote Sensing

Calendar Description

Concepts in Geographic Information Systems (GIS), remote sensing, and aerial photography are covered in this course. Students practice photogrammetry, stereovision and image interpretation, while working with a variety of hardcopy and digital imagery products. Scanners, digitizers, and Global Positioning System (GPS) instruments are used for data input, and students gain proficiency with the ArcGIS software package in tutorials, laboratory sessions, and projects that emphasize natural resource management applications.

Rationale

This course is required for first year students within the Environmental Sciences diploma. GIS is emerging as a primary data management tool for environmental practitioners. This course provides an overview of the theory and application of GIS and remote sensing, coupled with practical experience in the use of GIS to manage imagery and spatial data for environmental applications.

Prerequisites

SC 120

Co-Requisites

None

Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. describe environmental applications of remote sensing and GIS technologies.
2. recognize important wavelength bands
3. predict atmospheric interactions across various spectral regions
4. interpret remote sensing images.
5. distinguish applications of raster and vector GIS software.
6. discriminate basic data models for GIS.
7. demonstrate skills with the ArcGIS software package.

8. utilize scanners and digitizers as input devices for GIS.
9. georegister imagery.
10. use a GIS for operations such as overlay, buffering, route planning and basic modeling.
11. integrate field position data from raw coordinate sources (spreadsheets), GPS downloads (DNR Garmin), or textfile sources, within the ArcGIS working environment
12. manage GIS data in a network environment.
13. access spatial data from on-line (internet) sources.
14. Incorporate GIS and GPS data into map presentations.
15. Design and construct a presentation-quality photomap
16. Produce graphic output with a large-format plotter.

Essential Employability Skills

Essential employability skills are critical for workplace success and lifelong learning. Lakeland College prepares its graduates for the workplace and lifelong learning by integrating and promoting essential employability skills development in its curricula. Each credit course offered at Lakeland College emphasizes one or more of the following five essential employability skills:

A. **Communication Skills** that enable individuals to listen, interpret, express, and convey knowledge and ideas so that they are received and understood.
B. **Teamwork Skills** that enable individuals to respect the thoughts and opinions of others as they work together to plan activities, meet deadlines, complete projects, and contribute to an organization's goals.
C. **Critical Thinking Skills** that enable individuals to conceptualize and analyze issues from various perspectives while rationally evaluating the strengths and limitations of each perspective and deciding what action to take.
D. **Adaptability Skills** that enable individuals to respond quickly, willingly, and positively to new conditions and changing times.
E. **Positive Attitude and Behavioural Skills** that enable individuals to be confident about themselves and to deal with people, problems, and situations with honesty, integrity, and personal ethics.

Please refer to the Knowledge/Skills Matrix of this course outline to review the essential employability skills emphasized in this course.

Resource Materials

***Required Text*:**
Law, M., and A. Collins. 2018. Getting to know ArcGIS Desktop. Fifth Edition (updated for ArcGIS 10.6). ESRI Press, Redlands, CA. 748p.

***Reference Text*:**
Avery, T.E., and G.L. Berlin. 2010. Fundamentals of remote sensing and airphoto interpretation. 6th ed. Prentice Hall, Toronto, ON, 512 pp.

Lillesand, T.M., R.W. Kiefer, and J.W. Chipman. 2015. Remote sensing and image interpretation. 7th ed. John Wiley and Sons. Toronto, ON, 736 pp.

Conduct of Course

The hours in the Conduct of Course changed to 2 hours lecture weekly and a bi-weekly 4 hour lab. Academic Council Item of Academic Council April 27, 2020. Upgraded 07/05/2020 to Version 17 and sent notification.. The instructor discusses this time allocation as it pertains to your timetable and expected hours of homework, etc.

The lecture is a formalized classroom situation where the instructor discusses pertinent topics and students normally take notes. Student questions are encouraged to clarify subject areas. Numerous Internet resources are provided, and used to illustrate applications of remotely sensed imagery. E-mail is used to distribute assignments and readings, and to facilitate discussion and sharing of the many on-line GIS and remote sensing resources. Some lecture notes and supplementary materials are also provided by e-mail.

The lab component is composed of demonstrations, tutorial work and projects with different GIS software. Students are required to demonstrate competency with assigned GIS tasks. Self-study of tutorial material is required, and students are required to be proficient with GIS softwares and with common GIS tasks such as buffering, least-cost route planning, and GPS data management. There are also exercises and assignments in photogrammetry, image interpretation, and the use of scanners, digitizers, and GPS as input devices for GIS. Students complete projects involving the integration of digital aerial photos with GPS field data, and present their results with large-format plots and presentation software.

Students are reminded that unless **explicitly** instructed to the contrary, **all written submissions and lab projects must be original work**. See the Environmental Sciences Student Handbook for additional information.

Evaluation Procedures

Lecture exams contain discussion-type, short answer, matching, true false justify, and multiple-choice questions. The final grade for the course is weighted according to the following schedule:

Lecture exam I	25%
Lecture exam II	30%
Lab assignments and quizzes	45%
Total	**100%**

To obtain credit for this course **all lab reports**, **assignments**, **and projects must be completed and handed in**, **all labs must be attended**, and a minimum grade of D in the combined lecture/lab and project portions of the course must be achieved.

Late lab reports and assignments are not graded, and a grade of zero is assigned. It is the **student's responsibility** to manage the deliverables in this course. That includes **naming conventions** for network directories and program files, and for other storage media used for this course. Adequate **back-ups** for **all storage media** are required at **all times**.

Knowledge/Skills Matrix

Students apply and demonstrate their knowledge and skills to use

A. Communication Skills

A1.	**by listening, reading, interpreting information, and communicating effectively**
	Evaluation(s)/Goal(s): Lecture Exams, lab assignments/Goals 1-16
A2.	**by using written, spoken, and/or visual formats and media to communicate and meet needs of each particular audience**
	Evaluation(s)/Goal(s): Lab assignments/Goals 10, 14, 15, 16
A3.	**by using libraries, Internet, technical publications, journals and other sources to find pertinent information**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 10, 13-16

B. Teamwork Skills

B1.	**by using interpersonal skills to create an atmosphere that maximizes the strengths of group members to accomplish tasks**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 6-16
B2.	**by using interpersonal skills to resolve conflict, relate to others, and assist others**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 6-16
B3.	**by contributing and listening to others as group determines realistic objectives, prioritizes tasks, and identifies resources and timelines**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 7, 9-16
B4.	**by treating other members of the group open-mindedly and fairly**
	Evaluation(s)/Goal(s): N/A
B5.	**by developing tactics/strategies to accomplish tasks**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 6-16

C. Critical Thinking Skills

C1.	**by seeing critical thinking as a lifelong process of self-assessment**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 14-16
C2.	**by examining problems closely**
	Evaluation(s)/Goal(s): Lecture Exams, lab assignments/Goals 1-16
C3.	**by examining beliefs, assumptions, and opinions, and weigh them against the facts**
	Evaluation(s)/Goal(s): Lectures/Goals 4, 15
C4.	**by seeking out the truth**
	Evaluation(s)/Goal(s): Lectures/Goal 4

C5.	**by finding solutions; make decisions**
	Evaluation(s)/Goal(s): Lecture Exams, lab assignments/Goals 1-16
C6.	**by incorporating new ideas that may not necessarily agree with previous thought on the topic**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 6-16
C7.	**by seeing connections between topics and use knowledge from other disciplines to enhance reading and learning experiences**
	Evaluation(s)/Goal(s): Lecture Exams, lab assignments/Goals 1-16

D. Adaptability Skills

D1.	**by working independently or as part of team**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 6-16
D2.	**by carrying out multiple tasks or projects**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 6-16
D3.	**by being innovative and resourceful: identify and suggest alternative ways to get the job done**
	Evaluation(s)/Goal(s): Lab Assignments/Goals 6-16
D4.	**by being open and respond constructively to change and uncertainty**
	Evaluation(s)/Goal(s): Lab Assignment/Goal 15

E. Positive Attitude and Behavioural Skills

E1.	**by dealing with people, problems, and situations with honesty, integrity, and personal ethics**
	Evaluation(s)/Goal(s): Lecture Exams, lab assignments/Goals 1-16
E2.	**by showing interest, initiative, and effort**
	Evaluation(s)/Goal(s): Lecture Exams, lab assignments/Goals 1-16
E3.	**by affirming the need for positive solutions and encourage positive interaction and feedback**
	Evaluation(s)/Goal(s): Lab Assignments/Goal 15
E4.	**by balancing personal and family activities with job-related activities**
	Evaluation(s)/Goal(s): Lecture Exams, GIS competency exam, lab assignments/Goals 1-16

Grade Equivalents and Course Pass Requirements

A minimum grade of D (50%) (1.00) is required to pass this course.

Letter	F	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Percent Range	0-49	50-52	53-56	57-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	1.00	1.30	1.70	2.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Students must maintain a cumulative grade of C (GPA - Grade Point Average of 2.00) in order to qualify to graduate.

Attendance

Classroom and laboratory attendance is considered vital to the learning process and as significant to the students' evaluation as examinations and reports, therefore absenteeism is recorded.

a. Students having a combination of excused and/or unexcused absence of 20 percent or higher for the scheduled course hours can be required to withdraw and would then automatically receive a "RW" (required withdrawal) for the course, regardless of any other evaluation results. (RW is a failing grade).
b. An excused absence is one that is verified with your instructor. Verification should be prior to the absence or the next class day following the absence. Verification of the absence may take the form of a note from your doctor/College nurse regarding illness, or a note from another instructor regarding a field trip or other activity, or authorization by your instructor following an in-person meeting. Be sure to contact your instructor and ask what they will require from you as verification of each absence. An unexcused absence is anything NOT verified by the instructor prior to the absence or the next class day following the absence.

NOTE: Any exceptions to the above attendance policy (e.g. timetable conflicts, work-related issues) must be approved in writing by the Department Chair prior to the beginning of the course.

It is the students' responsibility to know their own absentee record.

Normal hours are 8:30 a.m. to 6:30 p.m., with potential for evening courses, exams or extended field trips. Students are expected to be available for classes during these times.

Course Units/Topics

1. Introduction
2. GIS Overview and Applications
3. Map Data Representation
4. Raster and Vector Data Models
5. Data Input and Editing
6. Remote Sensing Overview
7. Electromagnetic Energy
8. The Electromagnetic Spectrum
9. Light and Colour
10. Atmospheric Interactions
11. Satellites and Sensor Systems
12. Images and Resolution
13. Photographic Systems
14. Earth Resources Satellites
15. Thermal Sensing
16. Microwave and LIDAR
17. Image Interpretation

18. Cartographic Modeling
19. Data Issues
20. On-line Resources

***Tentative Laboratory Contents*:**

Laboratory sessions may cover more than one lab period, and may include significant individual project work. Specific projects and assignments vary, but may include the following:

1. Introduction to GIS programs
2. GIS Tutorials I
3. GIS Tutorials II
4. Visualization and Projection
5. Digital Image Georeferencing
6. Mosaicking Images and Displaying GPS Data
7. Creating a Wetlands Layout
8. Park Photomap Presentation
9. Plotting a Presentation Map
10. Trail Mapping: GPS Tracks to Shapefile
11. Community GIS Project

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