# SC 120

# Maps, Air Photos and GPS

### 3 Credits


Instructor: Kris Novak
Phone: 780 853 8623
Original Developer: Chris Olsen
Current Developer: Kris Novak
Reviewer: Robin Lagroix-McLean


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2602 - 59 Avenue, Lloydminster, Alberta, Canada T9V 3N7. Ph: 780 871 5700
5707 College Drive, Vermilion, Alberta, Canada T9X 1K5. Ph: 780 853 8400
Toll-free in Canada: 1 800 661 6490

# SC 120 Version: 17

# Maps, Air Photos and GPS

## Calendar Description

This course is an introduction to map reading, map contents, coordinate systems and the National Topographic System (NTS maps). Students practice map interpretation, measurement, and scale calculations, and learn to interpret contours and visualize relief. Compass use and basic field orienteering is taught. Aerial photography is introduced, with an emphasis on an understanding of annotation, scale, measurement, indexing and purchase of both print and digital products. Students practice stereo viewing, and learn to relate aerial photos to maps at different scales. Global Positioning System (GPS) instruments are used for navigation, and students learn to collect and upload differentially corrected field coordinate data.

## Rationale

This course is required for first year students within the Environmental Sciences diploma. An understanding of maps and aerial photography is essential to workers in all sectors of the environmental industry. GPS is a fundamental measurement technology, and is also an important data collection tool for environmental workers.

## Prerequisites

None

## Co-Requisites

None

## Course Learning Outcomes

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

1. distinguish different kinds of maps.
2. calculate ground distances and areas from maps and air photos using a variety of methods.
3. work confidently with geographic, UTM and DLS coordinate systems.
4. describe the essential elements of a map.
5. apply the National Topographic System (NTS) of Canada to identifying, organizing and purchasing maps.

6. calculate UTM distances.
7. use DLS coordinates and addressing for navigation.
8. use a compass for field applications and as a map instrument.
9. organize the selection, purchase and use of aerial photos for environmental tasks.
10. apply stereoscopic techniques to the interpretation of aerial photos.
11. apply digital map and GPS software to trip planning, routing and waypoint tasks.
12. navigate with a GPS unit.
13. transfer waypoints and routes between the GPS and various mapping softwares.
14. use GPS to collect precise position data, to create waypoints and tracks, and to project positions.
15. manage GPS data collection in terms of datum and accuracy issues.

## 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*:**

Mekercher, R.B., and B. Wolfe. 1992. Understanding Western Canada's Dominion Land Survey System. University of Saskatchewan, Saskatoon. p. 26.

***Reference Texts:***

Arnold, R.H. 2015. Interpretation of airphotos and remotely sensed imagery. With accompanying CD-ROM Paperback – 2015. CBS Publishers & Distributors, Mumbai, 1st Ed. p. 249.

Avery, T.E., and G.L. Berlin. 1992. Fundamentals of remote sensing and airphoto interpretation. 5th ed. Maxwell McMillan, Toronto. p. 472.

Campbell, J. 2003. Map use and analysis. 4th ed. McGraw-Hill, Toronto. p. 384.

Kimerling, A.J., A.R. Buckley, P.C. Muehrrcke, and J.O. Muehrcke. 2009. Map Use: Reading and Analysis. ESRI Press, Redlands, CA. p. 493.

***Required Materials*:**

Students are required to provide the following equipment for their **first, and all subsequent**, labs:

- Triangular scale ruler (987 18 SI metric)
- Soft lead pencil (HB)
- Soft plastic eraser
- Calculator (a simple scientific model, capable of computing square roots and reciprocals. **No programmable, metric conversion, or Smart-phone models are permitted**)

## Conduct of Course

The course consists of 2 hours of lecture each week and a bi-weekly 4 hour lab. 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.

The lab component is comprised of demonstrations, exercises, and quizzes involving the interpretation of NTS maps and aerial photographs. Numerous scale conversions, area calculations and distance determinations are done. Coordinate systems (UTM, latitude/longitude, DLS) are used each week. GPS, compass and orienteering exercises are conducted in the field during lab periods, and during off-hours as required by instrument bookings.

## Evaluation Procedures

Lecture exams contain discussion-type, short answer, true false justify, and multiple-choice questions. There is a graded exercise **that must be completed** during the lab period each week. All labs (except the first) begin with a **lab quiz** based upon the previous weeks

(**cumulative**) material. The final grade for the course is weighted according to the following schedule:

| | |
|---|---|
| Lecture exam I | 20% |
| Lecture exam II | 30% |
| Lab exercises | 20% |
| Lab quizzes | 30% |
| Total | 100% |

To obtain credit for this course all lab exercises and quizzes must be completed and handed in and **all labs must be attended**. A minimum grade of D in the combined lecture/lab portions of the course must be achieved.

Late exercises are not graded, and a grade of zero is assigned.

All exercises, quizzes, and exams are graded on a percentage (%) basis. Then, a total course percentage is calculated using the above weighting values. Finally, the total course percentage is converted to a grade basis using the grade scale that is after the Knowledge/skills matrix section.

## 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 Quizzes, Lab Exercises/Goals 1-15 |
| **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 Exercises, Lab Quizzes/Goals 5,7, 9, 10, 11, 13, 14 |
| **A3. by using libraries, Internet, technical publications, journals and other sources to find pertinent information** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises, Lab Quizzes/Goal 13 |

**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 Exercises/Goals 2-15 |
| **B2. by using interpersonal skills to resolve conflict, relate to others, and assist others** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises/Goals 2-15 |
| **B3. by contributing and listening to others as group determines realistic objectives, prioritizes tasks, and identifies resources and timelines** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises, Lecture Exams |
| **B4. by treating other members of the group open-mindedly and fairly** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises |

| | |
|---|---|
| **B5. by developing tactics/strategies to accomplish tasks** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises/Goals 2, 3, 6-15 |

**C. Critical Thinking Skills**

| | |
|---|---|
| **C1. by seeing critical thinking as a lifelong process of self-assessment** | |
| | **Evaluation(s)/Goal(s):** N/A |
| **C2. by examining problems closely** | |
| | **Evaluation(s)/Goal(s):** Lecture Exams, Lab Quizzes, Lab Exercises/Goals 1-15 |
| **C3. by examining beliefs, assumptions, and opinions, and weigh them against the facts** | |
| | **Evaluation(s)/Goal(s):** N/A |
| **C4. by seeking out the truth** | |
| | **Evaluation(s)/Goal(s):** N/A |
| **C5. by finding solutions; make decisions** | |
| | **Evaluation(s)/Goal(s):** Lecture Exams, Lab Quizzes, Lab Exercises/Goals 1-15 |
| **C6. by incorporating new ideas that may not necessarily agree with previous thought on the topic** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises |
| **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 Quizzes, Lab Exercises/Goals 1-15 |

**D. Adaptability Skills**

| | |
|---|---|
| **D1. by working independently or as part of team** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises, Lab Quizzes/Goals 1-15 |
| **D2. by carrying out multiple tasks or projects** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises, Lab Quizzes/Goals 1-15 |
| **D3. by being innovative and resourceful: identify and suggest alternative ways to get the job done** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises, Lab Quizzes/Goals 1-15 |
| **D4. by being open and respond constructively to change and uncertainty** | |
| | **Evaluation(s)/Goal(s):** Lab Quizzes, Lecture Exams |

**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 Quizzes, Lab Exercises/Goals 1-15 |
| **E2. by showing interest, initiative, and effort** | |
| | **Evaluation(s)/Goal(s):** Lecture Exams, Lab Quizzes, Lab Exercises/Goals 1-15 |
| **E3. by affirming the need for positive solutions and encourage positive interaction and feedback** | |
| | **Evaluation(s)/Goal(s):** Lab Exercises |
| **E4. by balancing personal and family activities with job-related activities** | |
| | **Evaluation(s)/Goal(s):** Lecture Exams, Lab Quizzes, Lab Exercises/Goals 1-15 |

## 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, Expectations, Course Outline

2. Mapping Overview
3. Map Scale
4. Geographic Coordinates
5. Dominion Land Survey (DLS) System
6. UTM Coordinate System
7. Distance, Area and Direction Measures
8. National Topographic System
9. Direction Determination
10. DLS Addressing and Navigation
11. Contours and Elevation
12. Profiles and Slope
13. Aerial Photography Overview
14. Air Photo Annotation
15. Air Photo Purchase and Coverage
16. Projection and Datum
17. GPS - System Overview
18. GPS - Accuracy and Measurement
19. GPS - WAAS and Differential Correction

***Laboratory Contents: (number and order may vary.)***

1. Conversions, Scale and Introduction to NTS Maps
2. Geographic Coordinates
3. Compass: Declination, Direction Determination, and Field Navigation
4. Dominion Land Survey (DLS) System
5. UTM Coordinates, Distance Calculations, and Distance Measurement
6. Douglas Protractor, Geographic Positions and Triangulation
7. NTS Grid, Roamers, and UTM at Reconnaissance Scale
8. DLS Addresses, Area, Resection
9. DLS Navigation, Linear Resection, Stereovision
10. Air Photos: Stereo Pairs, Annotation and Interpretation
11. GPS: Positioning, Accuracy, Datum
12. GPS: Waypoints, Averaging, Navigation, Mapping
13. GPS: Digital Maps and Route Planning

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