DOC.# 60

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE: PHOTOGRAMMETRY

CODE NO.: FOR104-4 **SEMESTER:** TWO/FIVE

PROGRAM: FORESTRY TECHNICIAN/WATER RESOURCES

AUTHOR: ERWIN GOERTZ

DATE: SEPTEMBER 1994 **PREVIOUS OUTLINE DATED:** SEPTEMBER 1992

APPROVED: _____ May 20/94

DEAN, SCHOOL OF SCIENCES & NATURAL RESOURCES

DATE

PHOTOGRAMMETRY — COURSE NAME

FOR104-4 — COURSE NUMBER

TOTAL CREDIT HOURS: 64

PREREQUISITE(S): None

I. PHILOSOPHY/GOALS:

The aim of this course is to provide the student with basic knowledge and skills in the principles and techniques of vertical air photo photogrammetry, interpretation and photography as it relates to forestry applications.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will:

1. Be familiar with the geometry of a vertical aerial photograph and be able to account for topographic displacement when determining distances and directions.
2. Be able to accurately determine the scale of a standard OMNR (Ontario Ministry of Natural Resources) aerial photograph in order to make distance, direction and area measurements.
3. Be able to view aerial photographs in three dimensions (stereo), delineate forest stands, identify cover types and tree species, and be able to measure tree heights.
4. Be able to use a vertical sketch master when transferring boundaries from aerial photographs to a base map.
5. Be familiar with satellite imagery analysis and G.I.S. applications.
6. Be competent in the use of a 35mm camera.

III. TOPICS TO BE COVERED:

1. Stereoviewing and deductive reasoning.
2. Geometry of a vertical aerial photograph.
3. Scale of a vertical aerial photograph.
4. Distance, direction and area on a vertical aerial photograph.
5. Vertical measurements on a vertical aerial photograph.
6. Tree species identification.
7. Stand typing.
8. The Vertical Sketchmaster.
9. Satellite imagery and G.I.S.
10. Using a 35 mm camera.

PHOTOGRAMMETRY — COURSE NAME

FOR104-4 — COURSE NUMBER

IV. LEARNING ACTIVITIES:

REQUIRED STUDENT RESOURCES:

1. INTRODUCTION:

1. Define photogrammetry and photo interpretation.
2. Identify the types of information needed in forestry and obtained from aerial photographs.
3. Understand that photogrammetry exists in order that we may verify what may be visual illusions in real life.

- none

2. STEREOVIEWING:

1. Define stereoviewing, stereoscope, stereopair, stereogram and supplementary aerial photography.
2. List two types of stereoscopes and the advantages and disadvantages of each.
3. Explain why two eyes are needed to see depth on a pair of aerial photographs.
4. Properly orient a stereoscopic pair of aerial photographs for three dimensional viewing.

- Pocket stereoscope
- Metric scale

3. GEOMETRY OF A VERTICAL AERIAL PHOTOGRAPH - PART I:

1. Identify different types of aerial photographs as to whether they are vertical, high or low oblique, or horizontal and sketch the shapes of the ground area covered by each type.
2. Give precise definitions for camera focal length and angle of coverage, and classify narrow, normal, and wide angle lenses according to focal length and angle of coverage.
3. Identify on an aerial photograph or sketch the fiducial marks, coordinate axes, and the three different photo centers on a slightly tilted aerial photograph.
4. List the type of distortion or displacement that radiates from the three photo centers.
5. Define ratioed and rectified prints and explain how each is obtained.
6. Identify the different components of the equation for topographic displacement and be able to solve problems based on the question.

- Scale/ruler
- Calculator

PHOTOGRAMMETRY — COURSE NAME

FOR104-4 — COURSE NUMBER

IV. LEARNING ACTIVITIES: (cont'd)

REQUIRED STUDENT RESOURCES:

4. GEOMETRY OF A VERTICAL AERIAL PHOTOGRAPH - PART II

1. Identify what we mean by rectified and ratioed aerial photographs and what we are correcting for.
2. Identify the different components of the topographic displacement equation and be able to solve problems based on the equation.
3. Identify which direction (towards the nadir or away from the nadir) a point is supposed to be moved in order to correct for topographic displacement.

- Scale/ruler
- Calculator

5. ORIENTATION OF OMNR AERIAL PHOTO STEREOPAIRS:

1. The student will be able to determine the percent stereo-overlap for a stereoscopic pair of aerial photos.
2. The student will be aware of correct handling and care procedures for OMNR aerial photographs.
3. Students will be aware of existing aerial photography available from both the federal and provincial government.
4. The student will be able to correctly orient an OMNR stereoscopic pair of aerial photographs for proper stereoscopic viewing.

- Stereoscopes
- Calculator
- Scale/ruler
- Masking tape

6. SCALE OF A VERTICAL AERIAL PHOTOGRAPH:

1. Define photographic scale and list the three common methods of expressing it.
2. Be able to identify at least two reasons why photo scale varies between photographs as well as within a single photograph.
3. List the two equations which are used to calculate photo scale and know how to use them.
4. Be able to calculate the average scale for a single OMNR aerial photograph.
5. Identify a large scale, medium scale and small scale aerial photograph.
6. Identify the camera focal length and the approximate aircraft flying height above mean sea level (amsl) for standard OMNR aerial photography.

- Scale/ruler
- Calculator

PHOTOGRAMMETRY — COURSE NAME

FOR104-4 — COURSE NUMBER

IV. LEARNING ACTIVITIES: (cont'd)

REQUIRED STUDENT RESOURCES:

7. IMAGE CHARACTERISTICS, STEREOVIEWING & DEDUCTIVE REASONING:

1. Understand the basic principles of aerial photograph interpretation.
2. Know the important characteristics used to identify objects on aerial photographs.
3. Be able to use deductive reasoning in order to identify objects on aerial photographs.

- Stereoscopes
- Scale/ruler
- Calculator

8. DISTANCE AND AREA ON A VERTICAL AERIAL PHOTOGRAPH:

1. Upon determining the scale of a single aerial photograph, the student should be able to accurately determine ground distances between two points on the aerial photograph.
2. The student will be able to determine areas on an aerial photograph and estimate the number of seedlings required to reforest an area such as a cutover or burned-over site.

- Metric and imperial scale
- Straight edge (ruler)
- Calculator

9. DIRECTION, DISTANCE AND AREA ON A VERTICAL AERIAL PHOTOGRAPH:

1. Be able to establish a known direction (baseline) on a single aerial photograph.
2. The student will be able to minimize the effects of topographic displacement on plot locations and thereby accurately determine the direction of a line.

- Metric and imperial scale
- Straight edge (ruler)
- Calculator
- Navigational protractor

10. DETERMINING DIRECTIONS IN THE FIELD:

1. Be able to establish a known direction (baseline) on a single aerial photograph.
2. Be able to traverse from one point on an aerial photograph to another point.

- Compass
- Pencil/clipboard
- Hardhat
- Dress for the weather (snowshoes if required)

PHOTOGRAMMETRY — COURSE NAME

FOR104-4 — COURSE NUMBER

IV. LEARNING ACTIVITIES: (cont'd)

REQUIRED STUDENT RESOURCES:

11. PLANNING A FOREST TIMBER CRUISE:

1. Upon determining the scale of a single aerial photograph, the student should be able to accurately determine ground distances between two points on an aerial photograph.
2. The student will be able to establish a known direction (baseline) on a single aerial photograph.
3. The student will be able to minimize the effects of topographic displacement on plot locations and thereby accurately determine the direction of a line.

- Metric and imperial scale
- Straight edge (ruler)
- Calculator
- Navigational protractor

12&13 VERTICAL MEASUREMENTS ON A VERTICAL AERIAL PHOTOGRAPH:

1. Be able to use the topographic displacement equation to determine heights on single aerial photographs.
2. Explain the problems associated with using the topographic displacement formula when measuring heights.
3. Name all the components of a parallax bar.
4. Explain how all the variables in the height equation are measure.
5. Be able to measure the heights of individual trees of forest stands on aerial photographs.

- Stereoscopes
- Metric scale
- Straight edge (ruler)
- Calculator
- Grease pencil

14. INTRODUCTION TO SATELLITE IMAGERY AND COLOR INFRARED (CIR) PHOTOGRAPHY:

1. Students should be familiar with the two sensors on board the active satellites and know how they operate.
2. Students should know what a PIXEL is and what pixel sizes are for the MSS and TM scanners.
3. Students should know the forestry applications of satellite imagery and color infrared photographs.

- none

PHOTOGRAMMETRY — COURSE NAME

FOR104-4 — COURSE NUMBER

IV. LEARNING ACTIVITIES: (cont'd)

REQUIRED STUDENT RESOURCES:

15. SATELLITE IMAGERY ANALYSIS & GEOGRAPHIC INFORMATION SYSTEMS (GIS):

1. Students should be familiar with basic satellite image analysis techniques.
2. Students should know what a GIS is and what it is being used for in the field of natural resource management.

- none

16,17 & 18 PHOTO INTERPRETATION AND TREE SPECIES IDENTIFICATION:

1. Be able to define photo interpretation and identify the steps required to reach a decision (convergence of evidence).
2. Identify image characteristics important to aerial photo interpretation and know their significance.
3. Identify tree species characteristics and be able to use them in identifying tree species on aerial photographs.
4. Be able to distinguish the major tree species on standard OMNR aerial photographs.

- Stereoscopes

19 & 20 FOREST STAND TYPING:

1. Identify and explain what each forest symbol represents including symbols for non-forested land, non-productive forested land and productive forested land.
2. Correctly designate the species composition of a stand given the tree species present.
3. Delineate individual forest stands on standard OMNR aerial photography.
4. Identify the forest species present within a delineated stand.

- Stereoscopes
- Grease pencil
- Eraser

PHOTOGRAMMETRY — COURSE NAME

FOR104-4 — COURSE NUMBER

IV. LEARNING ACTIVITIES: (cont'd)

REQUIRED STUDENT RESOURCES:

21. THE VERTICAL SKETCHMASTER:

1. Know the working principle of the Vertical Sketchmaster.
2. Identify the components of a Vertical Sketchmaster.
3. Be competent in the use of a vertical Sketchmaster.

- Stereopair of aerial photographs which you typed in the previous lesson
- Pencil/eraser
- Technical pen (0.35mm)

22 & 23 USING A 35mm CAMERA:

1. Be able to identify the components of a 35mm camera.
2. Be able to load film into a 35mm camera, take properly exposed photographs and unload the film.
3. Be able to take photographs emphasizing various depths of field.

- 35mm camera (manual camera preferably)
- roll of 12 exposure color print film, ASA/ISO 100

PHOTOGRAMMETRY — COURSE NAME

FOR104-4 — COURSE NUMBER

V. EVALUATION METHODS:

Evaluation will be based on lab assignments as well as written tests. To successfully complete the course, the student must have a passing grade in both the tests and the assignments. Lab assignments will make up 25% of the final grade, with tests comprising the remaining 75%. There will be three (3) tests throughout the semester each worth 25%. Regular attendance is necessary in that any student missing a lab assignment or test without a legitimate reason will receive an "I" grade in that test or assignment. Students receiving "I" grades on three tests and/or assignments will receive an "R" grade in the course.

Note:

There will be no rewrite at the end of the semester. The instructor is available during non-class time for extra help. Please do not pass up this opportunity if you find yourself needing it.

GRADES:

A+	90 - 100%
A	80 - 89%
B	70 - 79%
C	60 - 69%

VI. REQUIRED STUDENT RESOURCES:

- Pocket stereoscope
- Calculator
- Engineer's scale (10 to 60 points)
- Masking tape
- Black Stabilo grease pencil
- Metric scale (1:500 to 1:2500)
- Navigational protractor
- Lens cleaning paper

VII. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY BOOK SECTION:

Sayn-Wittgenstein, L. 1978. Recognition of tree species on aerial photographs. Forest Management Institute. Canadian Forestry Service. Information Report FMR-X-118.

Zsilinszky, V. G. 1966. Photographic interpretation of tree species in Ontario. Ontario Department of Lands and Forests.

Paine, D. P. 1981. Aerial photography and image interpretation for resource management. Forest Management Department, Oregon State University, Corvallis, Oregon.

VIII. SPECIAL NOTES:

Students with special needs (e.g. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.