Canadian Board of Examiners for Professional Surveyors
Core Syllabus Item
C 7: REMOTE SENSING AND PHOTOGRAMMETRY

Syllabus Topics:

Principles of modern quantitative remote sensing using optical, infrared, and microwave radiation: basic characteristics of electromagnetic radiation, interaction between radiation and terrestrial materials and atmospheric constituents, and characteristics of sensor systems and their measurements (e.g., passive and active sensors); Sensor models: resolution, spectral, and spatial response; Spatial transform: convolution; Corrections and calibration: noise reduction, radiometric calibration, geometric corrections; Classification: principles, supervised/unsupervised classification, accuracy evaluation.

Data acquisition systems employed in aerial and close-range photogrammetry: analogue versus digital cameras, metric versus non-metric cameras, and frame versus line cameras; Stereo-coverage: objective, overlap, and side lap; Project planning; Mathematical relationship between image and object space: collinearity and coplanarity conditions; Orientation procedures: Interior, Exterior, Relative, and Absolute orientation; Measurement and correction of image coordinates; Aerial triangulation: strip triangulation, block adjustment of independent models, and bundle adjustment; Quality Assurance (QA) and Quality Control (QC) of photogrammetric mapping: camera calibration, system calibration, precision, and accuracy.

Recommended Prior Knowledge and Skills:

Item C1: Mathematics
Item C2: Least-Squares Estimation and Data Analysis
Item C3: Advanced Surveying
Item C4: Coordinate Systems and Map Projections
Item C5: Geospatial Information Systems
Item C6: Geodetic Positioning

Learning Outcomes:

In order to satisfy the requirements of this syllabus item, candidates should have, at an introductory level:

- the ability to explain and illustrate the role of remote sensing and photogrammetry in mapping applications (image acquisition, image measurement, object reconstruction, and information retrieval), (see Essential Reference Materials ENGO 431, Chapters 1 – 8; ENGO 435, Chapters 1 – 6; Elements of Photogrammetry (with Applications in GIS), Chapters 11 and 17; Remote Sensing of the Environment: An Earth Resource Perspective, Chapters 1 and 6);

- the ability to work in a basic fashion with remote sensing imagery (optical, infrared, and microwave radiation), spatial transform (convolution), corrections and calibration (noise reduction, radiometric calibration, and geometric corrections), geometric manipulation (registration, geo-coding, and ortho-rectification), and thematic classification (supervised/unsupervised classification and accuracy evaluation), (see Essential Reference Materials ENGO 431, Chapters 1 – 8; ENGO 435, Chapters 1 – 6; Elements
of Photogrammetry (with Applications in GIS), Chapters 13 and 14; Remote Sensing of the Environment: An Earth Resource Perspective, Chapter 6); and

- the ability to apply concepts and principles of determining spatial positions using photogrammetric techniques (e.g., machine-to-image coordinate transformation, space intersection, and space resection), (see Essential Reference Materials ENGO 431, Chapters 5 – 8; Elements of Photogrammetry (with Applications in GIS), Chapters 11 and 17).

In addition, candidates should have, at an introductory level, the ability to:

- perform mission planning for airborne sensing operations, (see Essential Reference Materials ENGO 431, Chapters 7 and 8; Elements of Photogrammetry (with Applications in GIS), Chapter 18; Remote Sensing of the Environment: An Earth Resource Perspective, Chapter 4);

- assess geo-referencing data acquired with tools such as GPS and inertial technologies, and control requirements in photogrammetric networks, (see Essential Reference Materials ENGO 431, Chapters 7 and 8; Elements of Photogrammetry (with Applications in GIS), Chapters 16 and 17);

- assess the quality of different rectification methodologies (e.g. ortho-rectification, polynomial rectification), (see Essential Reference Materials ENGO 435, Chapter 5; Elements of Photogrammetry (with Applications in GIS), Chapter 13; Remote Sensing of the Environment: An Earth Resource Perspective, Chapter 6);

- discuss the concept of electromagnetic radiation and how it interacts with matter, particularly land surface, oceans, and atmosphere, (see Essential Reference Materials ENGO 435, Chapter 4; Remote Sensing of the Environment: An Earth Resource Perspective, Chapter 2);

- infer valid information from remote observations (e.g., electromagnetic spectra), (see Essential Reference Materials ENGO 435, Chapters 1 – 4; Remote Sensing of the Environment: An Earth Resource Perspective, Chapters 10 – 13);

- apply the principles, techniques, and practice of the quantitative analysis of digital imagery, (see Essential Reference Materials ENGO 431, Chapter 5 – 8; Elements of Photogrammetry (with Applications in GIS), Chapters 11, 14, 15 and 17);

- demonstrate an understanding of remote sensing technologies and their spatial and temporal sampling characteristics, (see Essential Reference Materials ENGO 435, Chapters 1 – 4; Remote Sensing of the Environment: An Earth Resource Perspective, Chapter 12);

- relate observations to models (mathematical, computational, and conceptual) of photogrammetric data, (see Essential Reference Materials ENGO 431, Chapter 5 – 8; Elements of Photogrammetry (with Applications in GIS), Chapters 11 and 17; Remote Sensing of the Environment: An Earth Resource Perspective, Chapter 6); and

- apply the concepts and principles of determining spatial positions using photogrammetric techniques, (see Essential Reference Materials ENGO 431, Chapter 5 – 8; Elements of Photogrammetry (with Applications in GIS), Chapters 11 and 17; Remote Sensing of the Environment: An Earth Resource Perspective, Chapter 6).

**Essential Reference Material:**

Study notes from the University of Calgary:
ENGO 431: Principles of Photogrammetry
http://dprg.geomatics.ucalgary.ca/Courses/ENGO431

ENGO 435: Introduction to Remote Sensing
http://dprg.geomatics.ucalgary.ca/Courses/ENGO435


**Supplementary Reference Material:**


Supplementary references 1 – 4 deal with remote sensing and image processing principles and their applications. Supplementary references 5 – 9 deal with the necessary photogrammetric principles for object space reconstruction from imagery.