NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING

GEOLOGICAL ENGINEERING PROGRAM

GE114 – REMOTE SENSORS APPLIED TO GEOLOGY

I. GENERAL INFORMATION

CODE	:	GE114 Remote Sensors Applied to Geology
SEMESTER	:	8-10
CREDITS	:	3
HOURS PER WEEK	:	5 (Theory–Practice–Laboratory)
PREREQUISITES	:	GE112 Geomorphology and Photogeology GE520 Introduction to GIS
CONDITION	:	Elective
DEPARTMENT	:	Geological Engineering

II. COURSE DESCRIPTION

The course prepares students for the application of remote sensing for extracting information about land surface structure, composition or subsurface. It combines information from different sources including satellite imaging, aerial photography, open path and complementary measurements. Geological applications of remote sensing includes surficial deposit, bedrock mapping, lithological mapping, structural mapping, sand and gravel exploration and exploitation, mineral exploration, hydrocarbon exploration, environmental geology, geobotany, baseline infrastructure, sedimentation mapping and monitoring, geo-hazard mapping and so on.

III. COURSE OUTCOMES

At the end of the course, the student:

1. Organize satellite images through union bands.
2. Interpret the meaning if colors in bands combinations.
3. Understand the meaning and values of spectral signatures and absorption zones.
4. Interpret spectral signatures for different types of coverage and minerals.
5. Construct spectral signatures through ASCII data using values of wave length and reflectance from spectrometers.
6. Identify the different types of hydrothermal anomalies.
7. Analyze hydrothermal anomalies using geological data and Geographic Information Systems GIS.

IV. LEARNING UNITS

1. REMOTE SENSORS

Definition, purpose and uses / Origin, evolution and state of the art / Physics fundamentals of remote perception / Nature of electromagnetic radiations / Electromagnetic spectrum / Object reflectance on ground surface / Energetic interaction in the atmosphere.

2. PLATFORMS, SENSORS AND IMAGES

Passive and active sensors / Aerial platforms / Functional characteristics of sensors / Spatial platforms / Image formats / Visualization of Landsat and Aster images / Color tables, histograms and contrast adjustment.

3. ELECTROMAGNETIC SPECTRUM

Introduction / Electromagnetic fundamentals / Object reflectance on ground surface / Energy interactions in the atmosphere / Ratios: emission, reflection, absorption and transmittance.

4. SPECTRAL SIGNATURE
Introduction and fundamentals / Atmospheric windows / Absorption zones / Active and passive microwave sensors / Radar images, uses and advantages / Radar signal fading / Useful bands in radar images / Effect of underground penetration.

5. MODELS OF DIGITAL ELEVATION
Introduction / Pushbroom stereo images (Aster, Ikonos, Orbview, Quickbird, Spot, etc.) / Rational polynomial coefficients RPC / Along track stereo images / Across track stereo images.

6. GEOGRAPHIC INFORMATION SYSTEMS GIS
Definition and concepts / Uses and applications.

V. PRACTICAL EXPERIENCE

1. Visualization and calibration of Landsat and Aster images.
2. Cloud masking, snow, water bodies, vegetation. Band combinations.
3. Image views.
4. Image sharpening, decorrelation stretch, saturation stretch.
5. Band ratios and indexes.
6. Principal component analysis PCA.
7. Spectral libraries and spectral signatures.
8. Resampling of spectral signatures.
9. Image sampling. Classification methods (SAM, CEM, MTMF, SFF, LSU).
10. Comparison of spectral signatures.
11. Exporting anomalies to vectors for using in GIS or Google Earth.
12. Mosaics.
13. Models of digital elevation.
14. Anaglyphs.

VI. METHODOLOGY

This course is carried out in theory, practical and computer laboratory sessions. In theory sessions, the instructor introduces concepts, theorems and applications. In practical sessions, several problems are solved and their solution is analyzed. In laboratory sessions, students analyze images and data using specialized software applications. At the end of the course, students should hand in and expose an integrating paper and project. In all sessions, students' active participation is encouraged.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + EF + PP) / 3

EP: Mid-term Exam EF: Final Exam
PP: Average of 10 practical works.

VIII. BIBLIOGRAPHY

1. Jean Yves Scanvic
   Applied Teledetection
   Paraninfo Ed. Madrid, 2015.

2. Sabins F.F
   Remote Sensing: Principles and Interpretation.
   N.Y.W.H. Freeman and Company, 2015