Course Outlines
JEE 684 - GIS and Remote Sensing
Semester 2/2018
13.30-16.30 – EN 3204, 2nd Fl., JGSEE-SEEM Building
Every Monday from 14 January 2019 to 27 May 2019

Course content:

This course will focus on basic concepts of Geographic Information System (GIS) and Remote Sensing (RS) as tools to better address the energy, environment and sustainability issues in real world applications. This is a "project style" **intensive** course with, 40 % of the course dealing with the GIS applications, and 60% with remote sensing technical background. Each lecture will cover theoretical basic background of the subject followed by hands-on or lab sessions. The QGIS and ENVI software's will be used.

The main expected learning outcomes of this course are:

- Student should be able to use any GIS and RS software regardless of being thought that program;
- Student should be able to understand technical GIS terms and maps that they, their peers or professionals have made;
- Student should be able to understand the basics of Land Use-Land Cover map preparation and logically interpret the results;
- Students should be able to understand technical background of GIS and RS and its applications to environmental and energy related fields;
- Students should be able to understand current research, technology and application of third level data to policy development and their potential applications in the energy, environment and sustainability related issues.

Course outline and schedule:

	Date	Topics	Details	Lecturers
1	Mon 14 Jan 2019	Introduction to GIS and RS course	• Background evaluation and requirements • Computer (hardware and software) • Introduction to the course • Materials and literature • Course evaluation system	Dr. Savitri Garivait & Ajarn Uday Pimple
		Introduction to RS	• Definition • History • Principles • Usefulness & Applications • Challenges	Ajarn Uday Pimple & Dr. Savitri Garivait

	Date	Topics	Details	Lecturers
2	Mon 21 Jan 2019	Basic physics of satellite and RS	• Concept of RS • What the sensor measures in RS? • EM spectrum basics • Types of RS • Applications • Data available from RS • Tools and software's Lab 1: Introduction to ENVI and satellite images Assignment 1	Ajarn Uday Pimple & Dr. Savitri Garivait
3	Mon 28 Jan 2019	Introduction to GIS	• Definition of GIS • Components of a GIS • Role and benefits Lab 2: Introduction to QGIS • Data types • Data sources • Level of measurements Lab 3: QGIS: symbol, labels and annotations Assignment 2	Dr. Asamaporn Sitthi & Ajarn Uday Pimple
4	Mon 04 Feb 2019	Spatial data Map projection and coordinates	• Introduction • Maps and their influence on the character of spatial data • Thematic characteristics of spatial data • Map projections • Coordinate system Lab 4: Geo-referencing Assignment 3	Dr. Asamaporn Sitthi
5	Mon 11 Feb 2019	Database management	• Introduction • Creating database • Data transformation • GIS database applications Lab 5: GIS database management Assignment 4	Dr. Asamaporn Sitthi
6	Mon 18 Feb 2019	Data analysis	• Data attributes • Data queries • Database model Lab 6: GIS data analysis Assignment 5	Dr. Asamaporn Sitthi

	Date	Topics	Details	Lecturers
7	Mon 25 Feb 2019	GIS modeling and its applications	• Introduction • Spatial data models • Spatial data structures • Modeling networks and surfaces • Building computer world Lab 7: processing modeler Assignment 6	Dr. Asamaporn Sitthi
8	**Mon 4 Mar 2019 (13:30-15: 30)**	**Mid-term exam**	**Mid-term exam (closed book)**	**Dr. Asamaporn Sitthi & Ajarn Uday Pimple**
9	Mon 11 Mar 2019	Basics of electromagnetic radiation and its application in RS	• Concept of system and electromagnetic radiation • Radiation principles and sources • Effect of atmospheric radiation • Basics of radiative transfer • Basic terminologies related to electromagnetic radiation • IFOV • Image characteristics • RS platforms • RS data preparation Lab 8: Download Landsat image for the area of interest Assignment 7	Ajarn Uday Pimple & Dr. Savitri Garivait
10	Mon 18 Mar 2019	RS using Landsat data Introduction to image processing	• Summary of Landsat history and mission • Data levels • How to download Landsat imagery • Image properties • Size of Image • Visual interpretation of image • Image processing techniques • Image enhancement and contrast enhancement through histogram stretching • Color composite • Vegetation indices Lab 9: Handling Landsat image in ENVI Assignment 8	Ajarn Uday Pimple & Dr. Savitri Garivait

	Date	Topics	Details	Lecturers
11	Mon 25 Mar 2019	Pre-processing of Landsat imagery Basics of image processing Digital image classification	• What is pre-processing • Why it's important • Image errors and artifact • Geometric correction • Radiometric correction • Effects of topography and clouds and their shadows Lab 10: preprocessing of Landsat imagery Assignment 9 • Structure of a digital image • Image file formats • Digital image processing system • Fundamentals of classification • Image classification workflow • Classification approach • Classification types Lab11 unsupervised classification Assignment 10	Ajarn Uday Pimple & Dr. Savitri Garivait
12	Mon 01 Apr 2019	Digital image classification	• Training phase (basic concepts) • Supervised classification Lab12: supervised classification Assignment 11	Ajarn Uday Pimple & Dr. Savitri Garivait
13	Mon 08 Apr 2019 (Vacation Day: Dynasty Chakri's Day) **Make-up Class: Saturday 06 Apr 2019 (9.00-12.00)**	Digital image classification	• Training phase (basic concepts) • Supervised classification • Training and testing • Confusion matrix Lab 13: supervised classification and sample preparations for field survey Assignment 12	Ajarn Uday Pimple & Dr. Savitri Garivait
14	Mon 22 Apr 2019	Field survey preparation: allocation of samples, sampling methods	• Survey sample determination • Map and geolocation preparation Assignment 13	Ajarn Uday Pimple & Dr. Savitri Garivait

	Date	Topics	Details	Lecturers
15	Mon 29 Apr 2019	Field Survey	Field Survey	Ajarns Uday Pimple & Kumron Leadprathom or Sukan Pungkul & Dr. Asamaporn Sitthi
16	Mon 06 May 2019 (Vacation Day: Coronation Period) **Make-up Class: Saturday 11 May 2019 (9.00-12.00)**	Post classification methods and accuracy assessment	• Post classification techniques • Accuracy assessment Lab 14: supervised classification comparisons and accuracy evaluation Assignment 14	Ajarn Uday Pimple & Dr. Savitri Garivait
17	**Mon 13 May 2019 (13:30-15: 30)**	**Final written exam on RS**	**Final exam (closed book)**	**Ajarn Uday Pimple & Dr. Savitri Garivait**
19	Mon 20 May 2019	Special lecture	IMPACT toolbox for Land use land cover applications	Dr. Dario Simonetti
20	**Mon 27 May 2019 (13: 30-18:00)**	**Final exam**	**Mini project presentation and report submission**	**Ajarn Uday Pimple & Dr. Savitri Garivait**

References:

Textbooks:

Richards, J.A. and Jia, X. **Remote Sensing Digital Image Analysis: An Introduction (4th edition)**, Springer, Verlag Berlin Heidelberg (2006)

Jensen, J.R. **Introductory Digital Image Processing: A Remote Sensing Perspective (3rd Edition)**, Upper Saddle River, N.J: Prentice Hall (2004)

Canty, M.J. **Image Analysis Classification and Change detection in Remote Sensing: with Algorithms for ENVI/IDL and Python (3rd edition)**, CRS Press Taylor and Francis Group, Boca Raton, FL (2014)

Schowengerdt, R.A., **Remote sensing Models and Methods for Image Processing (3rd edition)**, Elsevier Inc. (2007)

Lavender, S. **Practical handbook of remote sensing**, Taylor & Francis Group, Boca Raton, FL (2016)

Burrough, Peter A. and McDonnell, Rachael A. **Principles of Geographical Information Systems**, New York: Oxford university press. (1998).

Chang Kang-tsung. **Introduction to Geographic Information Systems**, Singapore: McGraw Hill. (2012).

Course assessment:

Student learning outcome will be assessed through three methods.

The first method is the practical assessment to evaluate if the student can complete given assignments.

The second method is the theoretical assessment to evaluate if the student can understand the theoretical concepts thought during course.

The third method is practical implementation assessment to evaluate if the student can implement learned practical and theoretical knowledge to real research studies.

The following percentage will be allocated to each assessment:

Criteria	Assessment (%)	Assessment of topic
Assignments	20	Assignments (50 % GIS & 50 % RS)
Mid-term exam	20	Written exam on GIS
Final exam	30	Written exam on RS
Mini project	30	Implementation of one project per student

Note: Mini-project evaluation will be conducted based on the understanding of the implementation. Mini project should include a concise report (not more than 3-5 pages) and short presentation of 15-20 minutes.

Course Coordinator and Supervisor: Assoc. Prof. Dr. Savitri Garivait

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Instructors:

1. **Savitri GARIVAIT** (JGSEE, Associate Professor)

Expertise: Atmospheric chemistry and environmental physics, air pollutant emission estimation and projection, air quality, biomass resource assessment.

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2. **Uday PIMPLE** (JGSEE, Researcher)

Expertise: Remote sensing applications to energy related environmental issues with special emphasis on remote sensing of forest environments.

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3. **Dr. Asamaporn SITTHI** (SWU, lecturer)

Expertise: WebGIS, cartography and data mining for social sensing and its application to environmental and social sciences.

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4**. Dario SIMONETTI** (JRC, GIS analyst programmer)

Expertise: Development of tools for forest time series analysis with special emphasis on deforestation and degradation

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5. **Kumron LEADPRATHOM** (Royal Forest Department, Forest officer)

Expertise: Forest field survey, forest ecology and biodiversity

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6. **Sukan PUNGKUL** (Royal Forest Department, Forest officer)

Expertise: forest field survey and forest biomass estimation

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